Activity Report 2025

Rasmusson, Monika; Karayiannidis, Yiannis

2026

Document Version:
Publisher's PDF, also known as Version of record

Activity Report 2025

AUTOMATIC CONTROL | LUND UNIVERSITY

LUND
UNIVERSITY

Department of Automatic Control
P O Box 118, 221 00 Lund, Sweden
www.control.lth.se

Annual Report TFRT--4053
ISSN 0280–5316

Activity Report 2025

LUND
UNIVERSITY

Department of Automatic Control

MAILING ADDRESS
Department of Automatic Control
Lund University
P.O. Box 118
SE-221 00 LUND, Sweden

VISITING ADDRESS
Department of Automatic Control
Ole Römers väg 1
223 63 LUND

TELEPHONE
+46 46 222 87 87

WWW AND GENERIC E-MAIL ADDRESS
www.control.lth.se
control@control.lth.se

Edited by Yiannis Karayiannidis and Monika Rasmusson

Printed: Media-Tryck, Lund, Sweden, April 2026
ISSN 0280-5316
Annual Report TFRT-4053

Content

Introduction

A summary of the activities at the Department of Automatic Control, Lund University during the period January 1 to December 31, 2025

AUTOMATIC CONTROL HIGHLIGHTS OF 2025

2025 was a year marked by both achievement and stability for our department. We welcomed four new PhD students, bringing our team to 51 members, corresponding to 45 full-time equivalents.

Education remained a strong and expanding pillar of our activities. Our portfolio of nineteen undergraduate courses attracted increasing interest, not least with the launch of a new course on *Cloud Computing*. Already in its first year, the course drew more than 160 signed-up students. In total, 1 329 students successfully completed our courses during the year, and 60 students presented their Master's theses at the department.

At the doctoral level, we offered two PhD courses and celebrated six successful PhD defenses, raising the total number of PhD graduates from the department to 151. In addition, two Licentiate theses were defended.

Our engagement within the WASP research programme continued to strengthen. Seventeen PhD students were funded within WASP, including six industrial PhD students, while a further five PhD students were WASP affiliated and actively participated in courses within the WASP Graduate School. Several doctoral students also took part in international study trips during the year, visiting destinations such as Singapore, the USA, and the Netherlands, opening up new opportunities for networking and research collaboration.

In late November, the department hosted the well-established euRobotics Week, a three-day event organized under the AI Lund umbrella together with the Department of Computer Science and the Cognitive Robotics Lab. This year, the event coincided with the ELLIIT Focus Period on *Robot Learning*.

Our research visibility remained high across Lund University and the Faculty of Engineering due to the various profile areas. The project *Historical Female Influencers in Automatic Control* was highlighted at several national and international events and conferences, and a new portrait was added to the growing collection. From 2026 onwards, the project will shift focus towards *Future Female Influencers in Automatic Control*.

From a financial perspective, the department maintained a stable position, reporting a net result of 1.8 MSEK and a total turnover of 71.4 MSEK.

Among the year's notable events were the ELLIIT Focus Period on *Robot Learning*, organized by Björn Olofsson and Yiannis Karayiannidis, and the *Swedish Control Conference*, organized by Karl Erik Årzén together with the Technical and Administrative team. Looking ahead, the department will organize another ELLIIT Focus Period, this time on *Optimization for Learning*, as well as *ECRTS 2026*.

Towards the end of the year, Margret Bauer was appointed Honorary Doctor 2026 at the Faculty of Engineering, Lund University. Another highlight was the appointment of Anders Rantzer as Honorary Chair Professor at National Sun Yat-sen University in Taiwan, where three of his former postdoctoral researchers now hold faculty positions.

In 2025, the department's first ERC Advanced Grant project concluded in August and was followed by the award of a new ERC Advanced Grant to Anders Rantzer, securing funding for the coming five years. We were also successful in attracting new funding from VR, ELLIIT, and WASP, enabling the recruitment of new PhD students and postdoctoral researchers.

Automatic Control continues to play a central role in the rapid development of AI and machine learning and their applications. We remain committed to advancing innovative research in the field while continuing to offer high quality education at both undergraduate and graduate levels.

Yiannis Karayiannidis and Monika Rasmusson

Education

Education at undergraduate and graduate level including dissertations 2025

UNDERGRADUATE STUDIES

The engineering education at LTH, the engineering faculty of Lund University, follows the central European system with five-year programs leading up to the university degree civilingenjör, with the international title MSc. in engineering.
Automatic control courses are taught as part of the engineering curricula in Engineering Physics (F), Electrical Engineering (E), Computer Engineering (D), Mechanical Engineering (M), Information and Communication Engineering (C), Environmental Engineering (W), Engineering Mathematics (Pi), Industrial Management and Engineering (I), Biotechnology (B), Engineering Nanoscience (N), Chemical Engineering (K), and Biomedical Engineering (BME). Our advanced courses are included in more than fifteen master-level specializations across the various programs. A course on Applied Robotics is also given within the Master's programs in Architecture.

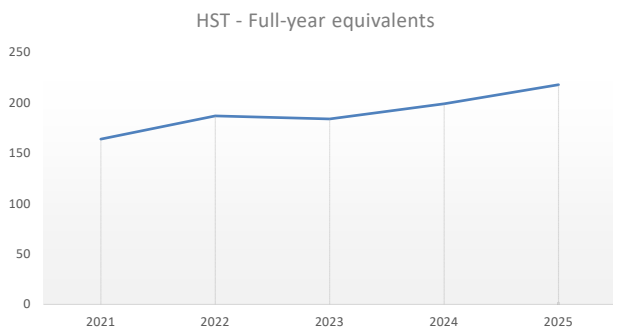
During 2025, there were 1 677 course registrations and 1 329 passed grades were awarded, which corresponds to 218 full-year equivalents. The list on the next page presents our undergraduate courses, along with the number of students who passed each course. Some of our courses have become so popular that we, unfortunately, have had to restrict the number of students. This is a result of limited staff resources and limited availability of lab and computational infrastructure. 60 students completed their Master's Thesis projects, and a total of 42 theses were presented. A list of the Master's Theses is given in the *Publications and Seminars* chapter.

The two-year international master program Machine Learning, Systems and Control was started in 2020. The program is managed by Mikael Nilsson at the Mathematics Department and Bo Bernhardsson. In 2025 a sixth batch of 28 students were admitted, which is at the similar level compared to previous year.

Many of our courses have course material available via a publicly accessible Canvas page.

This year a new course on *Cloud Computing* was started. The course is open for students at the Computer Engineering and Information and Communication Engineering programs, and a total of 166 signed-up students already in its first year! The course is given with support from Ericsson, which provided the necessary cloud infrastructure resources.

Our teachers are also involved as guest lecturers in courses beyond our own. Charlotta Johnsson was involved as a guest speaker in the Master courses *Automation in Complex Systems* and *Innovation Engineering*.



Development over the last five years of full-year equivalent

TOTAL NUMBER OF STUDENTS WHO PASSED OUR COURSES 2025

Automatic Control, Basic Course
(FRTF05 Reglerteknik) 554
Physiological Models and Computations
(FRTF01 Fysiologiska modeller och beräkningar) 37
Systems Engineering
(FRTF10 Systemteknik) 49
Control Theory
(FRTF15 Reglerteori) 22
Introduction to Machine Learning, Systems and Control
(FRTF25 Introduktion till maskininlärning, system och reglering) .....
Real-Time Systems
(FRTN01 Realtidssystem) 42
Nonlinear Control and Servo Systems
(FRTN05 Olinjär reglering och servosystem) 31
Automatic Process Control
(FRTN25 Processreglering) 24
Network Dynamics
(FRTN30 Nätverksdynamik) 31
Mathematical Modeling, Advanced Course
(FRTN45 Matematisk modellering, fortsättningskurs) 47
Optimization for Learning
(FRTN50 Optimering för maskininlärning) 37
Automatic Control, Advanced course
(FRTN55 Reglerteknik, fortsättningskurs) 59
Real-Time Systems
(FRTN60 Realtidssystem) 5
Modeling and Learning from Data
(FRTN65 Modellering och inlärning från data) 66
Project in Systems, Control and Machine Learning
(FRTN70 Projekt i system, reglering och maskininlärning) 46
Learning-Based Control
(FRTN75 Inlärningsbaserad reglering) 43
Applied Robotics for Architectures
(FRTN80 Tillämpad robotik för arkitekter) 18
Applied Robotics
(FRTN85 Tillämpad robotik) 45
Cloud Computing
(FRTN90 Molnsystem) 111
Degree Project in Automatic Control
(FRTM01/FRTM05 Examensarbete i reglerteknik) 60
Bachelor Project in Automatic Control
(FRTL01 Kandidatarbete i reglerteknik) 2

GRADUATE STUDIES

The PhD education consists of four years of studies, but since most students have 20% of department duties, the nominal time for the PhD education is 5 years. In the Swedish system there is also a possibility to do a half-time thesis called a "licentiate". The general syllabus for PhD studies in Automatic Control states that the course requirement for a PhD degree is 90 credits, while the thesis scope is 150 credits.

In 2025 a total of six Doctoral Theses were defended by Felix Agner, Emil Vladu, Ylva Wahlquist, Jonas Hansson, Manu Upadhyaya and Pex Tufvesson. Two Licentiate Thesis were presented by Fethi Bencherki and Alba Gurpegui Ramón. During the year we have admitted Rasmus Kovács, Marco Dell'Oro, Karl Rydén and Christoffer Kjellson as new PhD students.

The following PhD courses were given at the department in 2025:

- *Robust Control;* Richard Pates, Dongjun Wu
- *Linear Systems*; Mark Jeeninga

There are also several PhD courses organized within the WASP Graduate School program, available for both WASP graduate and affiliated students. WASP Graduate School students are required to take WASP courses corresponding to at least 27 credits, including the mandatory course and at least 2 out of the 3 foundational courses. The WASP course *Autonomous Systems* was organised and taught by Bo Bernhardsson, together with colleagues at KTH and Linköping University, for approximately 40 WASP students from six universities.

Mandatory course	*Legal, Ethical and Societal Aspects of AI and Autonomous Systems*
Foundational courses	*Autonomous Systems*
	AI and Machine Learing
	Mathematics for Machine Learning
	Software Engineering and Cloud Computing
Elective courses	*Advanced Autonomous Systems*
	Deep Learning for Natural Language Processing
	Deep Learning
	Graphical Models, Bayesian Learning and Statistical Relational Learning
	High-dimentional statistics and optimization
	Interaction, Collaboration and Visualization
	Learning Feature Representations
	Learning Theory
	Planning and relational learning
	Reinforcement Learning
	Scalable Data Science and Distributed Machine Learning
	Topological Data analysis
	WASP project course
Introductory courses	*Introduction to logic for AI*
(not included in 27 credits)	*Introduction to Mathematics for Machine Learning*

WASP STUDY TRIP TO LOS ANGELES, FALL 2025

In late September Karl-Erik Årzén co-organized a WASP study trip to Los Angeles for around 40 WASP PhD students. The study trip contained visits to Caltech, UCLA, UC Irvine, University of Southern California, Jet Propulsion Laboratory, Google, AWS, and Syntiant Corp. One afternoon was spent on rental bikes at Santa Monica and the study trip dinner was held at a Mexican restaurant in Pasadena.

DOCTORAL DISSERTATIONS

This year six PhD students defended their theses. The abstracts are presented below.

Felix Agner

Emil Vladu

Ylva Wahlquist

Jonas Hansson

Manu Upadhyaya

Pex Tufvesson

CONTROL OF CAPACITY-CONSTRAINED NETWORKS

Agner, Felix

ISBN 978-91-8104-288-7

This thesis concerns control of capacity-constrained networks. These systems involve many agents interconnected by a resource distribution network. The capacity to generate and distribute this resource is constrained. This applies, for instance, to power grids, communication networks, smart surveillance camera networks, and district heating networks. District heating networks in particular are the main focus of this thesis. These systems distribute heat from producers to consumers through hot water pipelines. In this setting, the agents are the consumers in the network, who regulate the flow rate they receive from the network using control valves. Physical limitations limit these flow rates. Therefore, when the demand for heat is high, it may be impossible to satisfy the needs of all the agents. This can result in certain buildings becoming cold. This thesis presents several contributions in this setting.

Firstly: The nature of the flow rate constraints is investigated. In Paper I, it is shown that the set of feasible flow rates in a tree-structured district heating network is convex, allowing for convex optimization-based control structures. One such approach is proposed in the paper, in which the flow rates are distributed fairly between the agents. These control approaches require a model of the system hydraulics. In Paper V, a data-based method for establishing such a model is investigated in a laboratory environment.

Secondly: The limited network capacity should be utilized optimally. This is challenging in the multi-agent setting, where the agents regulate and actuate the flow of resources in a decentralized fashion. Papers II-IV concern controllers which not only asymptotically guide the network to an optimal resource distribution, but also function in the large-scale, multi-agent setting. These papers show that asymptotic optimality guarantees can be established using variations of standard proportionalintegral control. Papers II and III concern a linear system setting with input saturation, which is extended to a nonlinear setting in Paper IV.

ON PERFORMANCE GUARANTEES FOR SYSTEMS WITH CONIC CONSTRAINTS

Vladu, Emil

ISBN 978-91-8104-415-7

In this thesis, we provide a number of novel algebraic means of certifying stability and performance for linear systems constrained in various ways by cones. The purpose is mainly threefold: to provide mathematical statements with applicative potential, to unify seemingly dissimilar results in the literature and thereby increase understanding, and to advance the state of the art on dynamical systems with conic constraints, an area of control still in its infancy. The main contributions of the five papers contained in the thesis are as follows. Paper I provides an analytical upper bound on the deviation from H-infinity optimality of a certain controller class as a function of the deviation from symmetry in the state matrix. Paper II goes on to establish a diagonal solution to a Riccati inequality which certifies H-infinity optimality of a particular controller both when the open-loop state matrix is symmetric and when the closed-loop system is positive. In Paper III, a necessary and sufficient condition is given in the form of a stable coefficient matrix for a nonsymmetric Riccati equation to admit a stabilizing cone-preserving solution. This result is subsequently applied in Paper IV to obtain a nonsymmetric variant of the bounded real lemma in H-infinity control on self-dual cones. Finally, Paper V establishes an equivalence between the existence of a bounded linear functional satisfying a conic inequality and the satisfaction of certain integral linear constraints on trajectories confined to a cone. This result in turn yields a non-strict version of the Kalman-Yakubovich-Popov Lemma when the cone is taken as the positive semidefinite cone, thereby serving to further bring together linear-cone theory with the dominating linear-quadratic paradigm in control Modeling and Control of Pharmacological Systems.

MODELING AND CONTROL OF PHARMACOLOGICAL SYSTEMS

Wahlquist, Ylva

ISBN 978-91-8104-370-9

Personalized patient care has gained increasing attention in recent years. Precise drug dosing is critical for patient safety and good clinical outcomes, especially in intensive care units, where patients often are in critical conditions. Such treatments can include stabilizing blood pressure and heart rate or maintaining safe anesthesia levels. However, the inter-patient variability in the drug response makes finding a dosing regimen that works for all patients challenging. The problem with the most commonly used methods today is that they do not account (at least not sufficiently) for this variability, which can lead to under- or overdosing.

This thesis aims to solve these issues by improving modeling and control strategies for individualized drug dosing. These aims are to: 1) stabilize heart donor hemodynamics to enhance organ quality for transplantation, 2) streamline the identification of covariate models that capture the inter-patient variability in the drug response, and 3) develop control strategies resilient to disturbances and poor measurement signal quality. First, we demonstrate that precise blood pressure control can delay ischemic myocardial contracture in heart donors. However, the controller performance was limited by the inter-patient variability in drug response, which motivated further research on drug modeling. Therefore, we developed a method to automate the covariate modeling process using symbolic regression networks, which enabled us to find simple and interpretable models that capture this variability well. To evaluate the covariate model's performance, we needed to simulate a large dataset, which motivated the development of a fast simulator for pharmacokinetics. Therefore, we developed an efficient simulator that could simulate a large dataset in a fraction of the time compared to current available methods. Returning to the control problem, we proposed combining open- and closed-loop control for anesthesia using a Kalman filter. This allowed for robust control performance even when model errors, disturbances, and poor signal quality were present.

In conclusion, these contributions demonstrate how pharmacological modeling and control can improve drug dosing accuracy and patient safety. Adopting the methods provided in this thesis can lead to safer and more efficient healthcare.

SCALABLE CONTROL DESIGN FOR NETWORKED SYSTEMS : COORDINATION THROUGH LOCAL COOPERATION

Hansson, Jonas

ISBN 978-91-8104-543-7

This thesis investigates scalable control design for networked dynamical systems, which are of great importance due to their wide range of practical applications, including large-scale formation control. A central challenge in such systems is enabling agents to coordinate effectively based only on local and relative information, particularly as the system size increases. To address this, the thesis develops a framework for designing robust and scalable coordination protocols that maintain performance even in large formations.

Paper I introduces serial consensus, a novel coordination protocol where the closed-loop system mimics the behavior of multiple simpler consensus protocols interconnected in series. This structure enhances robustness and stability. Paper II applies serial consensus to vehicular formations, demonstrating that it ensures string stability regardless of underlying communication topology. In Paper III, the scalable performance results are extended to the case of high-order coordination of agents with nth-order dynamics ($n \geq 3$). A consequence of this result is that formations of double integrators with local integral control can maintain scalable performance while rejecting constant load disturbances.

Paper IV proposes a class of scalable nonlinear consensus protocols based on the core idea of serial consensus, that is, serializing coordination. This enables coordination of a broader class of systems more closely linked to real-world applications. A unifying theme across Papers I–IV is the study of large-scale dynamical systems and their transient behavior—often in cases where traditional analysis would deem them unstable. To address this, Paper V develops new tools for performance analysis based on ε-pseudospectra, providing a theoretical foundation for understanding transient amplification and robustness in high-order networked systems. Together, these results contribute to a new understanding of design principles of scalable control and its implications for large-scale dynamical systems, offering new perspectives on stability, performance, and robustness in distributed control design.

LYAPUNOV ANALYSES FOR FIRST-ORDER METHODS : THEORY, AUTOMATION, AND ALGORITHM DESIGN

Upadhyaya, Manu

ISBN 978-91-8104-589-5

This thesis, comprising four research papers, contributes to the field of systematic and computer-aided analyses and design of first-order methods. The first two papers focus on developing new methodologies, while the remaining two apply these techniques to refine complexity and convergence results, as well as to design new methods. A central theme of the work is the use of Lyapunov-type analyses, a structured proof technique with historical roots in the study of dynamical systems, which is widely used to establish complexity and convergence properties of first-order methods.

REAL-TIME BRAIN-COMPUTER INTERFACES

Tufvesson, Pex

ISBN 978-91-8104-695-3

A brain-computer interface (BCI) is a real-time system that converts a user's brain activity into commands, enabling control over applications such as moving a cursor on the screen. This conversion is made possible by machine learning techniques and other algorithms.

Historically, BCI research has focused on the analysis of brain signals offline. However, increasing computational power and algorithmic sophistication now allow real-time interaction, enabling systems to interpret brain activity and translate it into commands instantaneously. This is critical for neuroprosthetic applications where even millisecond-level improvements can produce more natural movement. Even in more playful areas of use, such as brain-controlled computer games, response time is important for creating an experience that can engage the user: "It's no fun if it lags". A key driver of these advances is machine learning. Unlike earlier BCIs that relied on fixed models, machine learning allows systems to adapt and continuously learn from user signals and behavior, fostering a more intuitive human-machine interface through ongoing feedback and mutual learning.

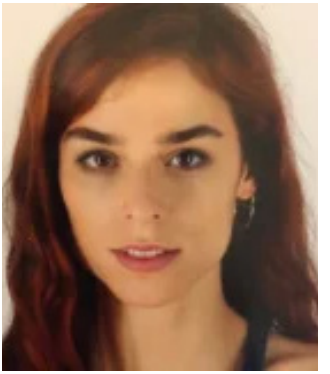
Despite these promising developments, significant challenges remain: real-time BCI systems demand high-performance hardware and software, require efficient wireless communication, robust processing capabilities, and adaptive algorithms. Furthermore, integrating these systems into real-world applications raises questions about usability and safety.

This thesis addresses some of these challenges, particularly in the context of reducing cognitive load, addressing latency uncertainties and developing a modular BCI research framework. This work presents new insights and pathways toward functional BCI systems. Through experimentation and novel system architecture, this research lays a foundation for the future of BCI technology.

LICENTIATE DISSERTATION

This year there were two PhD students presenting their Licentiate Theses. The abstracts are presented below.

Fethi Bencherki



Alba Gurpegui Ramón

POSITIVE NETWORK SYSTEMS: HEURISTIC METHODS AND OPINION DYNAMICS

Bencherki, Fethi

The analysis, control, and design of complex networks and systems represent an essential and ever-expanding field of study. At its foundation lie mathematical models that capture complex physical phenomena while remaining amenable to both analysis and design. These models prove instrumental in representing diverse systems such as power grids, cellular telecommunication networks, large-scale manufacturing processes, and computer systems. However, as technological and societal needs grow, these systems continue to increase in both complexity and scale, making their controlling tasks increasingly challenging. Traditional control approaches often fail to capture the uncertainties inherent in the modeling process, resulting in significant performance deterioration. Furthermore, these methods frequently suffer from poor scalability, rendering them unsuitable for large scale systems.

In response to these challenges, robustness and adaptation have emerged as critical design principles. Robustness ensures resilience against unmodeled dynamics, while adaptation addresses unexpected events and changes in the dynamics. Scalability, on the other hand, can be achieved by deriving localized control laws, thereby alleviating the limitations of centralized control approaches. The increasing affordability and accessibility of data measurements further provide a foundation for advancing these objectives. This has paved the way for data-driven approaches, which are now gaining traction as a preferred strategy.

The first paper of this thesis, Robust Simultaneous Stabilization via Minimax Adaptive Control, certifies the existence of adaptive minimax controllers. These controllers are a superior class of robust adaptive nonlinear controllers that can stabilize the plant in the presence of large model uncertainties.

The second paper, Robust adaptive data-driven control of positive systems with application to learning in SSP problems, presents another type of robust adaptive controllers. This controller is designed for a positive systems class, where the property of positivity is exploited to enable the scalability of these control solutions.

The third and final paper, Data-Driven Adaptive Dispatching Policies for Processing Networks, applies the framework from the second paper to processing networks. In this case, the processing rates of the different units are initially unknown. The paper analyzes the online performance of the learning-based adaptive policy.

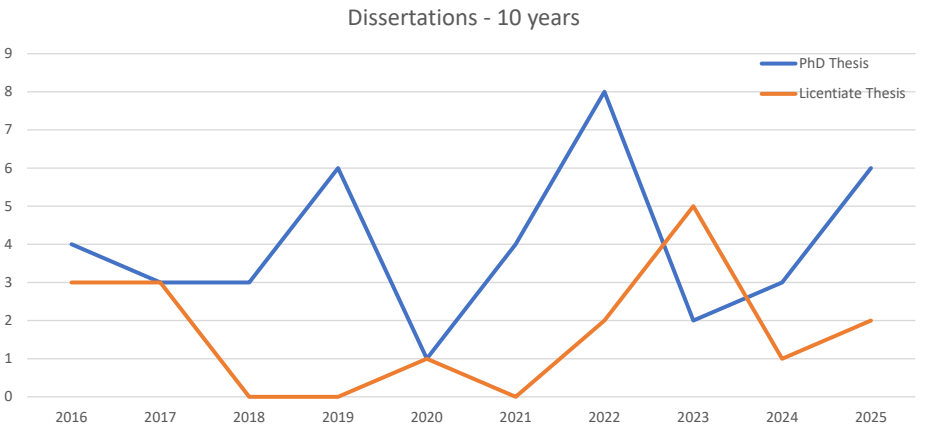
MINIMAX LINEAR REGULATOR PROBLEMS FOR POSITIVE SYSTEMS : WITH APPLICATIONS TO MULTI-AGENT SYNCHRONIZATION

Gurpegui Ramón, Alba

Exceptional are the instances where explicit solutions to optimal control problems are obtainable. Of particular interest are the explicit solutions derived for minimax problems, as they provide a framework for addressing challenges involving adversarial conditions and uncertainties. This thesis presents explicit solutions to a novel class of minimax optimal control problems for positive linear systems with linear costs, elementwise linear constraints in the control policy, and worst-case disturbances. We refer to this class of problems, in the absence of disturbances, as the linear regulator (LR) problem. Two types of worst-case disturbances are considered in this thesis: bounded by elementwise-linear constraints and unconstrained positive disturbances. Using dynamic programming theory, explicit solutions to the Bellman equation (in the discrete-time setting) and the Hamilton-Jacobi-Bellman equation (in the continuous-time setting) are derived for both finite and infinite horizons. For the infinite horizon case, a fixed-point method is proposed to compute the solution of the HJB equation. Furthermore, a necessary and sufficient condition for minimiz- ing the l1-induced gain of the system is derived and characterized by the disturbance penalty in the cost function of the minimax problem. This condition characterizes the solution of the l1–induced gain minimization problem and demonstrates that, if a finite solution exists for the minimax problem under the presence of worst-case, unconstrained and positive disturbances, the solution to the minimax setting reduces to that of the LR problem in the absence of disturbances.

This thesis also analyzes the stabilizability and detectability properties of the LR problem. Similar to the Linear-Quadratic Regulator (LQR) problem, the LR problem is shown to facilitate the stabilization of positive systems. A linear programming formulation is introduced to compute the associated stabilizing controller, if one exists. The scalability and practical advantages of this theoretical framework for large-scale applications are demonstrated through its implementation in an optimal voltage control problem for a DC power network and in the management of a large-scale water network. The second important contribution of this thesis is addressing positive synchronization on undirected graphs for homogeneous discrete and continuous-time positive systems. A static feedback protocol, derived from the Linear Regulator problem, is introduced. The stabilizing policy is derived by solving the linear programming formulation of the explicit solution to the LR problem under appropriate assumptions. Necessary and sufficient conditions are provided to ensure the positivity of each agent's trajectory for all nonnegative initial conditions. The effectiveness of this approach is illustrated through simulations on large regular graphs with varying nodal degrees.

Throughout the thesis, we demonstrate how the results can be applied to problems over networks with positive dynamics. Our results pave the way for robust networks that maintain stability and optimal performance despite adversarial conditions. By leveraging explicit solutions to minimax optimal control and multi-agent synchronization problems, this work provides a computationally efficient and scalable framework for controlling large-scale systems.



The number of dissertations incl both Doctoral and Licentiate Theses

Research

This chapter presents our excellence centers and describes our three main research branches and their ongoing projects

EXCELLENCE CENTERS AND NATIONAL PROJECTS

ELLIIT – The Linköping–Lund Initiative on IT and mobile communication
WASP – Wallenberg AI, Autonomous Systems and Software Program

ELLIIT – THE LINKÖPING–LUND INITIATIVE ON IT AND MOBILE COMMUNICATION

Funding: Government-funded Strategic Research Area

ELLIIT is a strategic research environment funded by the Swedish government in 2010, as part of its initiative to support strong research in information technology and mobile communications.

ELLIIT has four partners: Linköping University, Lund University, Halmstad University and Blekinge Institute of Technology.

It constitutes a platform for both fundamental and applied research, and for cross-fertilization between disciplines and between academic researchers and industry experts. ELLIIT stands out by the quality and visibility of its publications, and its ability to attract and retain top talented researchers and aims at being recognized as a top international research organization.

ELLIIT achieves its goals by a judicious choice of funded focus projects, a structured process for international recruitment, a balanced way of stimulating cooperation between research areas and between the sites involved (LiU, LU, BTH, HH), and a proactive approach towards fostering and maintaining cooperation with Swedish industry. The overarching objective of ELLIIT is to support scientific excellence in combination with industrial relevance and impact.

In the 2020 national budget bill for University Research and Education, an additional 72 MSEK/year were allocated to the strategic research area in IT and mobile communication with a focus on digitalization, i.e., an increase of the original budget with close to 200%. This initiated a major restart of ELLIIT including a new organization and restructuring of the research programme.

During 2025, ELLIIT organized two focus periods. One on *Visualization-Empowered Human-in-the-Loop Artificial Intelligence* in Linköping Apr 28 – May 30, and one organized by Yiannis Karayiannidis and Björn Olofsson at Lund University Nov 5 –Dec 5 on *Robot Learning*. The focus periods unite young international scholars, ELLIIT researchers and other top international academics active in the relevant domains.

Funding: Knut and Alice Wallenberg Foundation (KAW)

Wallenberg AI, Autonomous Systems and Software Program (WASP) is Sweden's largest individual research program ever, and provides a platform for academic research and education, fostering interaction with Sweden's leading technology companies. The program addresses research on AI and autonomous systems acting in collaboration with humans, adapting to their environment through sensors, information, and knowledge, and forming intelligent systems-of-systems. Software is the main enabler in autonomous systems and is an integrated research theme of the program. WASP's key values are research excellence and industrial relevance.

WASP is funded by the Knut and Alice Wallenberg Foundation with co-funding from industry and the involved universities. The program, which started in 2015, will continue until 2034 with a total budget of SEK 6.5 billion.

The graduate school within WASP provides the skills needed to analyse, develop, and contribute to the interdisciplinary area of AI, autonomous systems and software. The curriculum provides the foundations, perspectives, and state-of-the-art knowledge in the different disciplines taught by leading researchers in the field. Through an ambitious program with research visits, partner universities, and visiting lecturers, the graduate school actively supports forming a strong multi-disciplinary and international professional network between PhD students, researchers, and industry. The graduate school provides added value on top of the existing PhD programs at the partner universities, providing unique opportunities for students who are dedicated to achieving international research excellence with industrial relevance.

WASP involves eight Swedish universities together with numerous Swedish industries. At Lund University the following four departments participate: Department of Automatic Control, Department of Computer Science, Department of Electrical and Information Technology, and the Mathematical Imaging Group at the Department of Mathematics.

At the end of 2025, WASP funds the following positions at our department: 11 academic PhD students, 6 industrial PhD students (with Saab Kockums*2, Boliden, Sertech, Igelösa and Ericsson), 5 affiliated PhD students (funded from other sources), 1 Associate Professor (Emma Tegling).

Karl-Erik Årzén (WASP Co-director for Research Program Coordination since beginning 2021) and Anders Rantzer are both involved in the management of WASP. Monika Rasmusson is the WASP Financial Officer for Lund University.

PROFILE AREAS' WORK CONTINUES

The Department of Automatic Control is involved in several of the different profile areas.

LUND UNIVERSITY PROFILE AREA

Out of the five Lund University profile areas — Automatic Control is involved in one of them, namely *Natural and Artificial Cognition*.

Natural and Artificial Cognition
This profile area will extend our understanding of behavioral patterns of natural and artificial systems and develops new artificial cognitive abilities in software and systems. Cognition means how humans, animals and machines perceive, receive, process, store, retrieve and share information.

FACULTY OF ENGINEERING PROFILE AREAS

The faculty profile areas below have engagement from the Department of Automatic Control.

Engineering Health
Contributes to improving human health and solving challenges in healthcare by developing and providing new tools for diagnostics, treatments, and home care solutions.

AI and Digitalization
AI and digitalization are a rapidly growing part of the development of almost all engineering systems and will fundamentally change society and industry.

The Energy Transition
This area develops technical solutions together with academic partners across the world including the local research facilities ESS and Max IV. Equally important is to introduce the solutions through collaboration with industry and authorities, where the national competence centres form important networks.

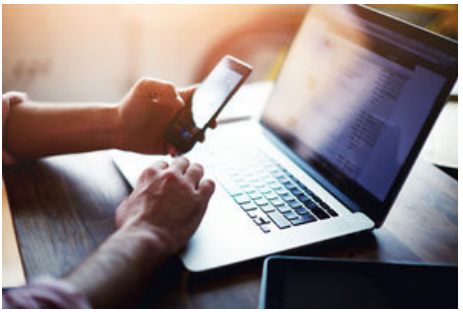
RESEARCH AREAS

The goal of the department is to provide students with a solid theoretical foundation combined with a good engineering ability. This is reflected in its research program, which covers both theory and applications. Automatic control, mathematics, and computer science form the core of all our research. To make our research more visible we have produced short films to be found on the department webpage.

The research activities can roughly be divided into three thematic areas:

LARGE-SCALE SYSTEMS AND LEARNING

What do traffic networks, wind farms, Facebook and economic markets have in common? They are all large-scale networked systems, which can be analyzed and optimized using automatic control techniques.



AUTONOMOUS REAL-TIME SYSTEMS

Their vision? To create user-friendly, self-adaptive, resilient, high-performing systems, with low latency and jitter, while being cost-effective.

INNOVATIVE CONTROL APPLICATIONS

This is a branch of application-driven research motivated by the desire to create a more sustainable society. It addresses several of the UN's 17 Sustainable Development Goals.

LARGE SCALE SYSTEMS AND LEARNING

What do traffic networks, wind farms, Facebook and economic markets have in common? They are all large-scale networked systems, which can be analyzed and optimized using automatic control techniques. By developing scalable methods for control and optimization, researchers at the Department of Automatic Control are contributing to solving one of the greatest challenges in modern engineering - the sustainable and safe operation of these large-scale systems.

A significant part of this field of research is directed towards developing theories and methodologies supporting the design and verification of distributed control structures. Other important parts focus on combining classical physics-based models with machine-learning tools, and combining models for traditional networks, for example, for electricity and heating, with learning algorithms for consumer behavior and decision-making. The aim is to improve efficiency and reliability, while at the same time reducing costs.

Ongoing projects:

- Scalable Control of Interconnected Systems (ERC project)
- Learning in Networks: Structure, Dynamics and Control
- Dynamics, Information and Control in Networks
- Dynamics of Complex Socio-Technological Network Systems
- Performance, Controllability, and Robustness of Large-Scale and Non-Normal Network
- Learning and Adaptation
- Scalable Optimization for Control Systems
- Automatic Luapunov Analysis of Optimization Algorithms
- Model Predicitve Control Stability Analysis
- Bregman Optimization Algorithms
- Algorithm Design using Steering Vestors
- AI-Driven Identification of Illicit Drugs and Chemical Warfare Agents via Secure Distributed Learning
- Visual Analytics of Large and Complex Myúltilayer Technological Networks
- Scalable Control of Electrical Power Systems
- Synthesizing Second-Life Batteries for Grid Support: A Multidisciplinary Approach
- Interpretable Safety and Performance Guarantees using Scaled Relative Graphs
- Optimal Estimation and Control at Scale

SCALABLE CONTROL OF INTERCONNECTED SYSTEMS

Researchers: Rantzer, Anders; Pates, Richard; Agner, Felix; Gurpegui Ramón, Alba; Wu, Dongjun
Funding: European Research Council - ERC Advanced Grant

Modern society is critically dependent on large-scale networks for services such as energy supply, transportation and communications. The design and control of such networks is becoming increasingly complex, due to their growing size, heterogeneity and autonomy. A systematic theory and methodology for control of large-scale interconnected systems is therefore needed. In an ambitious effort towards this goal, this project will address the following key aspects:

- Modeling by leveraging tools from learning and adaption
- Control design by utilizing structural properties of the system
- Verification of system performance using decomposable certificates

Energy networks will be used as a guiding example for the development of theory and methodology. Close collaboration with industrial partners will ensure that the research is relevant and useful in practice.

This project ended in August.

LEARNING IN NETWORKS: STRUCTURE, DYNAMICS, AND CONTROL

Researchers: Tegling, Emma; Rantzer, Anders; Gurpegui Ramón, Alba; Hansson, Jonas; Bencherki, Fethi; Ohlin, David; Jeeninga, Mark in collaboration with KTH Royal Institute of Technology and Umeå University
Funding: WASP NEST

Many complex systems, whether biological, physical, social, or economical, are structured in networks consisting of a large collection of interacting entities. Some of these networks, such as social networks on the Internet emerge without our control or intervention. As a consequence, their structure, the way their entities interact and evolve are a priori unknown. Some are designed and deployed by engineers, but their scale may become so large (this is for instance the case of future mobile networks) that their individual entities cannot be finely tuned when deployed, and again the structure of the network and the interactions between its entities cannot be predicted. Our ability to optimize the operation of a network, however, strongly relies on an accurate knowledge of its characteristics.

In this project, we will develop novel mathematical and computational tools to devise efficient algorithms learning the network structure and dynamics, as well as efficient ways to control it. This vast and ambitious objective calls for a multidisciplinary effort, and we envision to reach it leveraging and combining techniques from probability theory, statistical machine learning, and control theory.

DYNAMICS, INFORMATION AND CONTROL IN NETWORKS

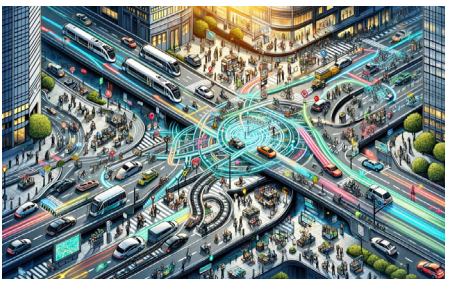
Researchers: Pates, Richard; Como, Giacomo; Rantzer, Anders; Tegling, Emma; Kjellson, Christoffer
Funding: ERC, VR

Large-scale networks play a constantly increasing role in our modern society, e.g., affecting the access to essential services like mobility and energy, influencing the outcome of electoral polls, and determining the quality of the economic systems.

The Department hosts a research group on Dynamics, Information, and Control in Networks. The focus of this group is on the mathematical foundations of large-scale network systems with particular emphasis on issues related to their resilience, centrality, and scalability. Applications include cyber-physical systems, transportation networks, as well as social and economic networks.

One project is focused on transportation networks, with publications about decentralized traffic signal control and distributed dynamic tolls.

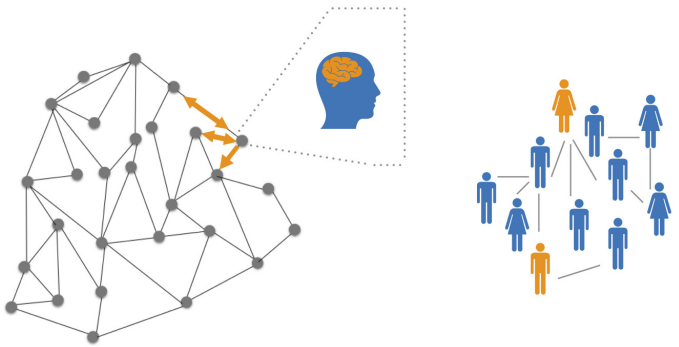
Another project studies the interplay between economics and traffic flows in transport networks. We will study exchange equilibria in traffic networks and network dynamics in presence of human decision makers. The goal is to gain deeper understanding of, and be able to exploit, the interaction between node demands and network flows.



DYNAMICS OF COMPLEX SOCIO-TECHNOLOGICAL NETWORK SYSTEMS

Researchers: Tegling, Emma; Como, Giacomo; Ohlin, David; Bencherki, Fethi; Bakovic, Luka; Jeeninga, Mark in collaboration with Linköping University
Funding: ELLIIT

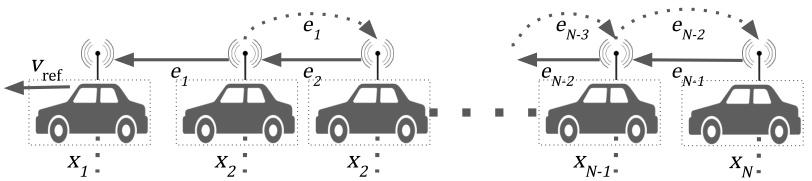
We investigate how opinions and beliefs propagate on social networks, i.e., on networks of individuals interacting over socio-technological media. We use data and dynamical models in order to understand the mechanisms by which sociologically relevant macroscopic collective behaviors, such as opinion polarization, can emerge from microscopic (i.e., individual-level) interactions.



PERFORMANCE, CONTROLLABILITY, AND ROBUSTNESS OF LARGE-SCALE AND NON-NORMAL NETWORK SYSTEMS

Researchers: Tegling, Emma; Hansson, Jonas; Kjellson, Christoffer
Funding: WASP

Characterizing the dynamic behaviors of interconnected systems is an important and to large extents open research problem. For example, it is important to understand how the structural properties of a network impact how well it can be controlled, and how robust it is to disturbances and model errors.



LEARNING AND ADAPTATION

Researchers: Grönqvist, Johan; Heskebeck, Frida; Bernhardsson, Bo; Rantzer, Anders
Funding: ERC and WASP

There are many important applications where classical physics based models need to be combined with machine learning tools. A good example is in autonomous driving, where automotive industry have extensive experience of control technology such as ABS braking, cruise control and ESP systems for vehicle stabilization. This technology now needs to be combined with machine learning methods to analyze traffic situations and human behavior. To do this in a safe and robust manner, it is essential to understand how learning algorithms for discrete sequential decision-making can interact with continuous physics based dynamics. Many other applications can be found. In the energy sector, well established control solutions for power networks and generators are increasingly being combined with learning algorithms for consumer behavior and decision-making, to minimize costs and optimize efficiency. In medicine, standard practice for disease therapies is combined with expert systems and sequential decision-making for medical diagnosis.

In our collaboration project with Alexandre Proutiere at KTH the aim is to bridge the gap between machine learning and control engineering. These research fields have traditionally evolved more or less separately, but in recent years the intersections in terms of applications as well theoretical challenges have been growing. This project is concerned with sequential decision making in systems whose dynamics are initially unknown, i.e., with adaptive control or reinforcement learning. Statistical models are of fundamental importance in both areas, but while learning theory has been focused on sample complexity and regret, the corresponding control literature is discussing stability robustness and asymptotic performance. An important focus of our project is the tradeoff between exploration and exploitation, sometimes known as ”dual control”. The optimal tradeoff strategy can be formulated as the solution to a dynamic programming problem. We study properties of the solution as well as computational schemes. Optimal strategies are compared with common heuristics, both in control and reinforcement learning.

SCALABLE OPTIMIZATION FOR CONTROL SYSTEMS

Researcher: Rantzer, Anders
Funding: ELLIIT

Modern control systems put new demands on control theory. Many of the modelling, analysis and design methods available do not scale well with increasing complexity. Applications and/or industrial practice often relies on distributed control structures, and there is a strong need for more systematic approaches to design and analysis of such structures and the corresponding information interfaces, especially with the development of ”internet of things” and the so-called ”smart society”.

An important challenge for control and optimization is industrial robots where the task is to plan and carry out an operation as fast as possible given a number of constraints in terms of accelerations, loads on the mechanical structure, energy consumption, etc. The constraints in combination with dynamical models of very high

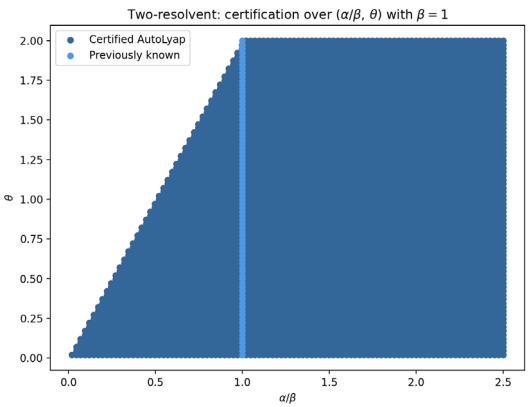
complexity imply a strong need for efficient optimization methods. There are several challenges. One is that the dynamics is nonlinear making the optimization problem highly non-convex.

Another is that re-planning of operations in real time due to obstacles makes the need for efficient optimization methods much more relevant than before. Current industrial standard does not allow for re-planning. Optimization for industrial robots has not been considered in previous ELLIIT projects. The vision is to, within 5 years, have online optimization routines performing planning and re-planning of optimal robot trajectories in real time. Another important challenge for control and optimization is robustness analysis of large-scale interconnected systems such as power grids. The introduction of renewables in the power grid requires high-fidelity models, which also imply a strong need for more efficient optimization methods. In this project we will investigate and develop new optimization methods and software for modelling, analysis and design of large-scale control systems that scale well with problem size. Within ELLIIT we have previously developed scalable robustness analysis methods assuming that suitable models where available. For systems like power grids, this is not the case. A major challenge is to, in a distributed manner, obtain linearized models for power grids, and to, in a distributed manner, build so-called LPV models which capture the uncertainties of the power grid. The vision for 5 years is to have efficient tools for modelling power-grids based on the Modelica modelling language which admits efficient analysis of robustness of the grid. This work will be carried out in collaboration with ABB Corporate Research in Switzerland.

AUTOMATIC LUAPUNOV ANALYSIS OF OPTIMIZATION ALGORITHMS

Researchers: Giselsson, Pontus; Upadhyaya, Manu, Åkerman, Anton; Nilsson, Max
Funding: VR and WASP

This project aims at automating the process of analysis and design of optimization algorithms. The basis of the project is to formulate the problem of analyzing convergence of an optimization algorithm as another optimization problem. This problem finds the worst case function, within the class of considered functions, given a performance metric. Based on this, we develop methodologies for finding Lyapunov functions for proving convergence, devise new algorithms, and find extended convergent parameter regions for existing methods.



MODEL PREDICTIVE CONTROL STABILITY ANALYSIS

Researchers: Giselsson, Pontus; Åkerman, Anton
Funding: WASP

Model predictive control is a control scheme in which an optimization problem is solved to find the next control action to apply. Explicit solutions rarely exist, and the optimization problem is typically solved using an optimization algorithm. The control application sets hard limits on how much time can be spent on solving the optimization problem each iteration. Most theory for model predictive control assumes that the optimization problems are solved to optimality, which is not feasible in practice. This project aims at establishing new theory for model predictive control stability analysis with the restriction that the optimization algorithm can only run a finite and pre-defined number of algorithm iterations each time a new problem is solved.

BREGMAN OPTIMIZATION ALGORITHMS

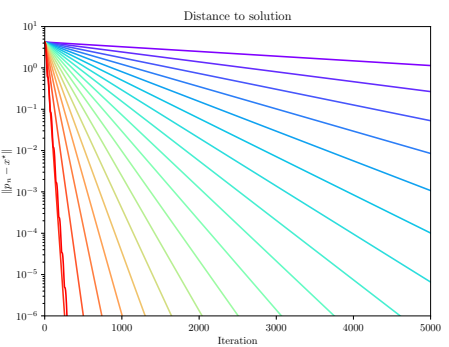
Researchers: Giselsson, Pontus; Nilsson, Max
Funding: WASP

First-order optimization methods are methods of choice for large scale optimization problems. In general, such methods are poor at adapting to the geometry of the problem and can perform poorly on ill-conditioned problems. This projects investigates the class of so-called Bregman first-order optimization methods that are designed to better capture the problem geometry than traditional first-order methods do. We investigate theoretical properties as well as their application in applications domains such as machine learning training.

ALGORITHM DESIGN USING STEERING VECTORS

Researchers: Giselsson, Pontus; Dell'Oro, Marco; Nilsson, Max
Funding: WASP

First-order optimization methods typically have global convergence guarantees but slow local convergence. Second-order and quasi-second-order methods generally lack global convergence guarantees but exhibit fast local convergence properties. This project aims to combine the benefits of first-order methods and (quasi-)second-order methods to achieve global convergence with good local performance. We focus in particular on large-scale problems and nonsmooth and or nonconvex settings, where traditional techniques are not applicable. Moreover, we develop and utilize the concept of so-called steering vectors that allows for safely infusing second-order directions into first order methods without the need for a costly line search.



AI-DRIVEN IDENTIFICATION OF ILLICIT DRUGS AND CHEMICAL WARFARE AGENTS VIA SECURE DISTRIBUTED LEARNING

Researchers: Giselsson, Pontus; Ydreskog, Markus
Funding: WASP

This project aims to enhance the rapid identification of illicit drugs and chemical warfare agents by integrating Raman spectroscopy with AI/ML and Federated Learning.

While Raman spectroscopy provides non-destructive chemical identification, its real-world application is often limited by the complexity of chemical mixtures and the legal or security-related restrictions on sharing sensitive spectral data. To address these challenges, the project focuses of three main objectives:

- Robust Mixture Identification: Developing methods capable of identifying individual components within complex chemical mixtures with overlapping peaks, low SNR and out-of-distribution components.
- Privacy-Preserving Federated Learning: Implementing a distributed learning framework that allows multiple organizations to collaboratively train models on sensitive data without sharing the raw spectra, ensuring both data privacy and protection against model drift.
- Practical Deployment: Integrating these algorithms into handheld devices (in collaboration with industrial partner Serstech to ensure real-time performance and high accuracy in field environments.

Ultimately, the project seeks to provide law enforcement, military, and public health agencies with more effective tools to combat the growing use of illicit drugs and mitigate the impact of chemical threats.

VISUAL ANALYTICS OF LARGE AND COMPLEX MULTILAYER TECHNOLOGICAL NETWORKS

Researchers: Kerren, Andreas, Linköping University; Pates, Richard
Funding: ELLIIT

Multilayer networks are a relatively new way to model complex real-world systems that demand novel and efficient solutions for their analysis. Especially when regarding large and heterogeneous data typically used in power systems control, the use of multilayer networks for data representation, modeling, and analysis is promising. To explore such multilayer technological networks and to incorporate the human perspective into the analysis process for increasing the trust into the results, interactive visualization approaches are key. This project will be performed in an interdisciplinary team; we will study and develop novel visual analytics approaches for the exploration and analysis of multilayer technological networks, which is not only highly relevant for the field of visual analytics, but also for the energy efficiency of power systems. /

SCALABLE CONTROL FOR ELECTRICAL POWER SYSTEMS

Researchers: Pates, Richard; Lindberg, Johan
Funding: ELLIIT

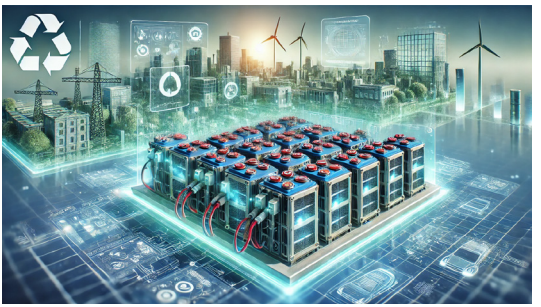
Electric power systems are undergoing huge changes due to the shift from conventional power production to more renewable-based generation like solar and wind. This is primarily driven by the need to mitigate climate change by reducing CO2 emissions. The shift to more generation from solar and wind will affect the dynamical behaviour of power systems, and consequently how they should be controlled. This project explores the role of optimal control with respect to these issues, with a view towards generating insights, fundamental limitations, and novel control strategies, that can be used to help the design and operation of future smart electrical power systems.

SYNTHESIZING SECOND-LIFE BATTERIES FOR GRID SUPPORT: A MULTIDISCIPLINARY APPROACH

Researchers: Pates, Richard; Hällström, Ask
Funding: COMPEL research initiative

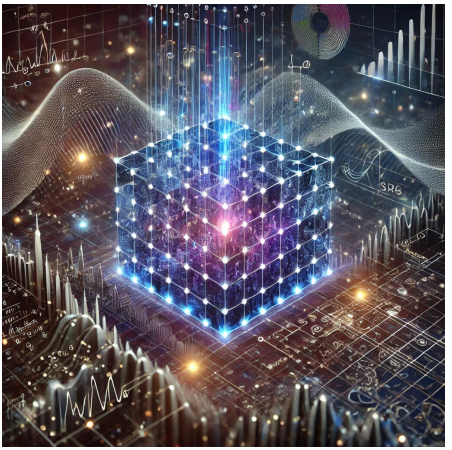
Batteries are central to supporting the renewable energy transition. However, there is a significant environmental and financial cost associated with the production of new batteries. The potential of repurposing retired batteries from various applications, such as electric vehicles, for use in areas like grid support, presents a unique and sustainable avenue to reduce these impacts and accelerate the use of batteries.

This project aims to explore the feasibility of assembling used batteries, no longer fit for their original purpose, to create 'new' batteries that can provide robust grid support. The basic idea is to connect many smaller, retired batteries to create a larger, heterogeneous battery. By exploiting advanced control theoretic techniques developed for interconnected heterogeneous systems, methods will be developed to quantify the capabilities and capacities of this hybrid battery, optimizing them for the new application domain.



INTERPRETABLE SAFETY AND PERFORMANCE GUARANTEES USING SCALED RELATIVE GRAPHS

Researchers: Pates, Richard; Nauta, Talitha



Ensuring the safety and reliability of autonomous systems is a fundamental challenge, particularly as they increasingly rely on complex, black box machine learning models. While such models provide exceptional predictive power, their lack of interpretability makes it difficult to guarantee robustness, especially in dynamic and uncertain environments. This project aims to develop new tools for analyzing and certifying the safety and performance of black box models, facilitating their integration into autonomous systems, using Scaled Relative Graphs as a unifying frame-

OPTIMAL ESTIMATION AND CONTROL AT SCALE

Researchers: Pates, Richard; Adlercreutz, Julia
Funding: ELLIIT

Many classical optimal methods for estimation and control have provable robustness and performance guarantees that can enhance the sustainability and resilience of engineering systems. However, their implementation typically requires all-to-all communication of sensor measurements, making them an infeasible choice for many practical applications. The aim of the project is to systematically investigate optimal estimation and control approaches through the lens of sparse linear algebra. In particular, the project aims to exploit techniques from sparse linear algebra to reduce the communication burden of classical optimal estimation and control methods. Reducing the need for communication will allow these methods to be applied in important sensor rich application areas, such as autonomous vehicles, transportation networks, and power grids. This has the potential to greatly improve energy efficiency and resilience in these applications, where suboptimal design approaches, that typically provide no formal guarantees, must currently be used for reasons of system scale.

AUTONOMOUS REAL-TIME SYSTEMS

A significant part of the research in this field revolves around cyber-physical systems, clouds, and cloud control. Historically, control systems have been deployed as monolithic software implementations on carefully tuned hardware, adjacent to the plants they control. This has resulted in systems that are undesirably non-modular, not easily extensible and that have limited ability to self-adapt. In contrast, feedback-based cyber-physical systems and cloud-native applications offer the prospect of greater accessibility and flexibility, as well as higher reliability and lower latencies. Furthermore, when applications are implemented in a disaggregated manner, their execution can be distributed across the system's many nodes, migrated, and scaled to meet individual objectives as well as that of the system as a whole.

Ongoing projects:

- Robust and Secure Control over the Cloud
- Ad-hoc Compute Offloading for Autonomous Connected Vessels
- Advanced Offloading for Real-Time Applications - AORTA

ROBUST AND SECURE CONTROL OVER THE CLOUD

Researchers: Nyberg Carlsson, Max; Årzén, Karl-Erik in collaboration with Linköping University
Funding: ELLIIT

The ELLIIT-funded research project Robust and Secure Control over the Cloud runs between 2021 and 2025 and is a collaboration between the Department of Automatic Control and the Embedded Systems Laboratory at Linköping University, with one PhD student at each site. The project has developed theory methodology to explore the interplay between local and cloud-based control as well as the trade-offs between robustness, security, and adaptivity. The Lund team focuses on the control and autonomy aspects, while the Linköping team focuses on security and optimization. The results will be verified in real feedback control experiments over the Cloud.

The Cloud, with its virtually infinite storage and computing capacity, provides ample opportunities for applying advanced control and estimation algorithms in completely new settings. While local feedback is needed to ensure the stability of individual control applications regardless of the current status of the network, the cloud is ideal for running high-level control and optimization algorithms in large-scale networked systems. Compute-intensive algorithms such as model-predictive control (MPC), particle filtering, and reinforcement learning can exploit the massive amounts of data generated by local devices to continuously adapt to the circumstances and optimize the overall system behavior. Fast-growing market demands, the need to reduce production cost, flexible product lines, and scalability issues are all driving forces towards shifting the control applications from being implemented on dedicated hardware to pieces of software running in the Cloud.

During 2022, we investigated timing-robust control over the Cloud using online parametric optimization. The goal is to adapt a linear networked feedback to unpredictable timing complications, such as long delays, aborted computations, and dropped packets. The core concept of the approach is to log successful sampling and actuation events and then, at regular intervals, use non-convex parametric optimization to improve the expected performance of the controller under the assumption that the future timing behavior will be similar to the current one. The expected future cost is computed using our Julia toolbox JitterTime.jl. To reduce the time complexity of the optimization algorithm, automatic differentiation in Julia is applied for efficient gradient descent. The approach has been evaluated on a physical ball and beam plant, where both the controller and optimization algorithm can be located in the Cloud.

AD-HOC COMPUTE OFFLOADING FOR AUTONOMOUS CONNECTED VESSELS

Researchers: Eker, Johan; Sundström, Emil
Funding: WASP WARA

The goal of this PhD project is to develop methods and tools to support dynamic offloading of demanding compute and AI functionality from limited connected devices to the cloud. Offloading has two main advantages. First, local resources are freed up. This can both be used to save power and battery life, and also improve local performance. Second, it allows the incorporation of advanced cloud services, for example, high-resolution image processing or AI-based decision making. Dynamics offloading requires a number of components. First, an application model that supports components to execute both locally and in the cloud, and migrate in between, is needed. Second, methods to handle the orchestration of components during run-time and dynamically allocate resources, including network (5G) and compute resources. The final piece is methods to expose changes in available resources to the application layer. This can for example include exposing changes in latency, bandwidth, jitter, etc.

The project targets the WARA Public Safety arena and is aimed at extending the services available for the drones and boats used in the demonstrator. The proposed research fall into the WASP software domain for supporting the development of autonomous systems.

This PhD project explores how smart devices such as drones and boats can become more powerful by sharing heavy computing tasks with the cloud. Instead of doing everything onboard, devices can "offload" demanding AI and data processing when needed, saving battery life and improving performance. The research develops new software tools that decide in real time where tasks should run — locally or in the cloud — based on available network speed, latency, and computing resources. The technology will be tested in public safety scenarios, helping autonomous systems react faster and operate more reliably in critical missions.

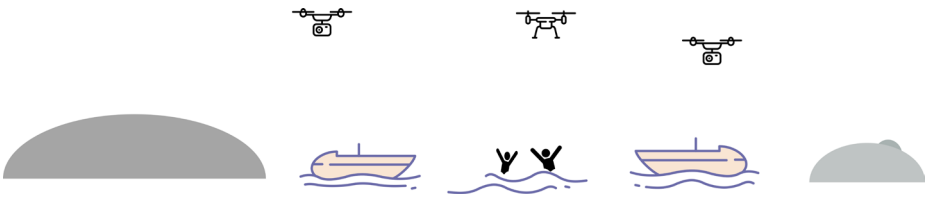


Figure: The project will target the WARA-PS rescue scenario, which involves a set of cooperating Connected drones and autonomous boats.

ADVANCED OFFLOADING FOR REAL-TIME APPLICATIONS - AORTA

Researchers: Årzén, Karl-Erik; Eker, Johan; Al-Bayati, Ahmed
Funding: Vinnova

The goal of AORTA is to develop a framework that allows offloading of real-time services and functionality to the edge and cloud, as well as integration of them with services in the edge/cloud.

The ambition is to support, for example advanced robotics or manufacturing applications in utilizing non-local services in a predictable fashion. We will build upon recent advances in predictable communication and compute technologies, such as TSN, Kubernetes and 5G. A new real-time computing platform consisting of a portable real-time virtual machine that supports dynamic code migration for offloading.

INNOVATIVE CONTROL APPLICATIONS

This is an area of application-driven research motivated by the desire to create a more sustainable society. It addresses several of the UN's 17 Sustainable Development Goals. It also has an impact on LTH's five core research areas, meaning that this field of research is important in digitalization, industry, the built environment, our climate, and life itself.

Numerous applications are being addressed, for example, within robotics, health care, the process industry, and smart manufacturing. A substantial part of the research takes place in the RobotLab LTH. Apart from research on automatic control, this focus area also concentrates on teaching and learning methods, standards for smart industries, and innovation indexes.

Much of the research is performed in collaboration with, and is co-funded by, industrial partners.

Ongoing projects:

- RobotLab LTH
- Autonomous Flight (UAS@Lund)
- Autonomous Force-Aware Swift Motion Control
- Intelligent trajectory predictions at sea using neural ordinary differential equations
- Hand-arm coordination control for robotic interaction tasks
- Optimizing the Next Generation Brain Computer Interfaces using Cloud Computing
- 2DCAM - Subsystem for two-coordinate positioning of the UAV auxiliary video camera
- UAVIPOD - Image Preprocessing and Object Detecting UAV System
- Force Control for Robotic Manipulation with Extrinsic Dexterity
- Intelligent Cloud Robotics for Real-Time Manipulation at Scale
- Data-driven Modeling for Sustainable Mining
- Trustworthy Cyber-Physical Pipelines
- Historical Female Influencers in Automatic Control
- Future Female Influencers in Automatic Control
- Task Centric Whole-Body Compliant Robot Control
- CAISA - Collaborative Artificial Intelligent Surgical Assistance
- Functional ex vivo heart evaluation
- DYNACON: DYNamic Attack detection and mitigation for seCure autONomy
- NextG2Com

ROBOTLAB LTH INFRASTRUCTURE

RobotLab LTH is a close collaboration between Deptartments of Automatic Control and Computer Science. Our main research is on autonomous robotic systems, with special focus on motion and compliance control, control and software system architectures, different sensor fusion problems, robot vision, and robot learning. RobotLab LTH has a long history of industrial collaboration. The lab had also spin-offs, e.g., Cognibotics AB and RiACT A/S. RobotLab LTH organizes a yearly outreach event for schools (a robotics week) attracting several hundred students each year in the context of the annual euRobotics Week. In addition, we also participate in other outreach activities like Her Tech Future, Kulturnatten, and similar events. RobotLab LTH is an Open Door lab that offers companies access to advanced robotics hardware and know-how. RobotLab LTH has hosted several Master Thesis projects in cooperation with industry, e.g., ABB, Axis, B&R, Modelon, Cognibotics, Combine, Bitcraze, TWI Ltd., Tetra Pak, and many more.

Equipment in the RobotLab

In RobotLab LTH there are e.g., ABB IRB120, IRB140, IRB2400, and YuMi with the IRC5 control system. Hardware interfaces have been developed to create an open system suitable for motion-control experiments and sensor feedback. A parallel-kinematic manipulator with a large working volume is available. A specialized robot for applications within construction robotics called Bettan is also available in the lab. We also have a KUKA IIWA dual-arm robot, and a UR5e and a Franka Emika Panda robot. Several mobile robot systems are also available: a Spot four-legged robot from Boston Dynamics, a MIR 200 wheeled mobile platform with a UR5e on top, and a mobile platform based on the Fraunhofer IPA Care-o-Bot/Rob-at-Work.

During 2024, a dedicated 5G network, that has been recently upgraded and integrated with ABB YUMI, was installed in the lab by Ericsson as part of the AORTA research project. The network is connected to the 5G/6G lab at the EIT department in the E-building, enabling edge computing and computational off-loading

AUTONOMOUS FLIGHT (UAS@LUND)

Participants: Bergström, Johan; Johansson, Rolf; Olofsson, Björn; Karayiannidis, Yiannis, in collaboration with Lund University School of Aviation.

This research project addresses and develops the technologies of unmanned flying systems (UAS or drones) in order to make such systems more suitable for addressing various societal challenges. A current collaboration project (UAV@LU, currently changing name to UAS@LU) addresses the potential of UAS for addressing societal challenges including, but not limited to, more efficient and sustainable forestry and farming, urban planning and landscape modelling, monitoring of critical infrastructure system, smarter transport, as well as more efficient and safe emergency service operations. A problem shared across all sectors mentioned above is making the UAS autonomous; the transition from actively piloting a UAV with continuous (human) control inputs from a remote ground station while having the UAV within visual line of sight to an autonomous UAS solving complex problems without continuous human control inputs but as an autonomous agent beyond the visual line of sight in an airspace populated by unmanned as well as manned aircraft. Consequently, the here proposed research project aims at developing and demonstrating autonomous flight missions in an airspace with mixed autonomous and manned aircraft under supervision and management of air traffic control. While the actors in the UAS@LU network represent a vast number of possible applications for autonomous UAS systems; this project will focus on two applications which are being developed with the purpose of enhancing societal safety: the cases of autonomous radiation detection and Search-And-Rescue (SAR). The project serves the wider purposes of the collaboration UAS@LU and is conducted by Lund University School of Aviation and the Lund University Deptartment of Automatic Control in close collaboration with research conducted at the departments for Nuclear Physics and Medical Radiation Physics. External actors include those involved in Testbed Ljungbyhed as well as actors collaborating with LU researchers in UAS applications for societal safety.

AUTONOMOUS FORCE-AWARE SWIFT MOTION CONTROL

Researchers: Jia, Zheng; Olofsson, Björn; Karayiannidis, Yiannis in collaboration with colleagues at Linköping University
Funding: ELLIIT

The research program for this project has a number of steps for moving autonomous force-aware swift motion control forward. Our recently derived novel methods for at-the-limit maneuvering will be extended to new scenarios, where previously non-dynamic kinematic models (with non-holonomic motion constraints) have been used under, sometimes highly restrictive, assumptions on limited slip and upper-bounded velocities. For example, maneuvering in highway driving at higher speeds (typically 70 km/h and higher) implies that consideration of the forces involved, i.e., the dynamic behavior, is of importance, e.g., if heavy-duty vehicles with their inherent roll sensitivity or mobile platforms with heavy manipulators onboard are considered. The new perspective has high potential to lead to new significant results with regard to planning and control strategies for a wide range of vehicle-maneuvering and robotic manipulation scenarios, and will also treat scenarios with multiple vehicles and moving robots, in traffic or on work sites. The core of the project is scientific questions in swift motion control that is safe, resilient, and efficient.

INTELLIGENT TRAJECTORY PREDICTIONS AT SEA USING NEURAL ORDINARY DIFFERENTIAL EQUATIONS

Researchers: Stoltenberg, Peter; Karayiannidis, Yiannis; Olofsson, Björn in collaboration with Saab Kockums AB
Funding: WASP

This is an Industrial PhD student project in collaboration with Saab Kockums within the Wallenberg AI, Autonomous Systems and Software Program (WASP).

This project develops methods for trajectory predictions of surrounding vessels at sea, by modeling of the interacting vessels combined with neural ordinary differential equations (ODEs), relying on input from a perception system, with the purpose of presentation to a human operator or utilization in an automated planning and control system. Operators of sea vessels make decisions about actions based on the current situational understanding, and how they predict various types of vessels will behave in the specific environment that they are operating in. Having models for such functionality, is a requirement for high-performance (semi-) autonomous sea vessels, and is significantly relevant for both manned vessels and autonomous surface vessels in dense and narrow environments like archipelagos and ports. Compared to the established approach in use in many systems, where trajectories of surrounding vessels are extrapolated holding a straight line and a constant velocity, the approach taken in this project contributes to a more realistic situational understanding and prediction by relying on an interaction-aware and physics-aware model that ensures physically reasonable and situation-specific trajectory predictions as output from the model.

The research questions that are the focus of this project are:

- How can modeling of interactions combined with neural ODEs and other known information be used for model-based trajectory predictions to achieve robust and safe naval autonomy?
- How should uncertainty for trajectory predictions be quantified and actively managed by interactions with the perception system in multi-agent settings for sea vessels?
- How should the system architecture for implementation of model-based trajectory prediction systems be designed to enable interactions with surrounding system components for full autonomy in naval applications?

HAND-ARM COORDINATION CONTROL FOR ROBOTIC INTERACTION TASKS

Researchers: Guberina, Marko; Karayiannidis, Yiannis; Olofsson, Björn
Funding: ELLIIT

The focus of the research project is the problem of robotic hand-arm coordination for the purpose of manipulation. Hand-arm coordination refers to simultaneous movement of robotic manipulators (arms) and grippers (hands) during object manipulation. This is contrasted by rigid grasping used in most current robotic manipulation.

The objective is to enhance robots' overall performance by overcoming the limitations of rigid grasping by allowing and controlling motion of the grasped object. Controlled regrasping enables faster task execution and smoother operation by enhancing the manipulability of the whole arm-hand-object system throughout robots' tasks. Apart from resulting in higher efficiency of the robotic system, hand-arm coordination also results in more natural and intuitive looking robotic motion.

In broader terms, the aim of the project is to develop sensor-based controllers that can endow robots with combined grasping and manipulation capabilities. The need for this comes from the desire of having robots work with and in human designed environments, and releasing the requirement for creating environments tailored to robots.

OPTIMIZING THE NEXT GENERATION BRAIN COMPUTER INTERFACES USING CLOUD COMPUTING

Researchers: Bernhardsson, Bo; Heskebeck, Frida; Bergeling, Carolina (BTH)
Funding: WASP

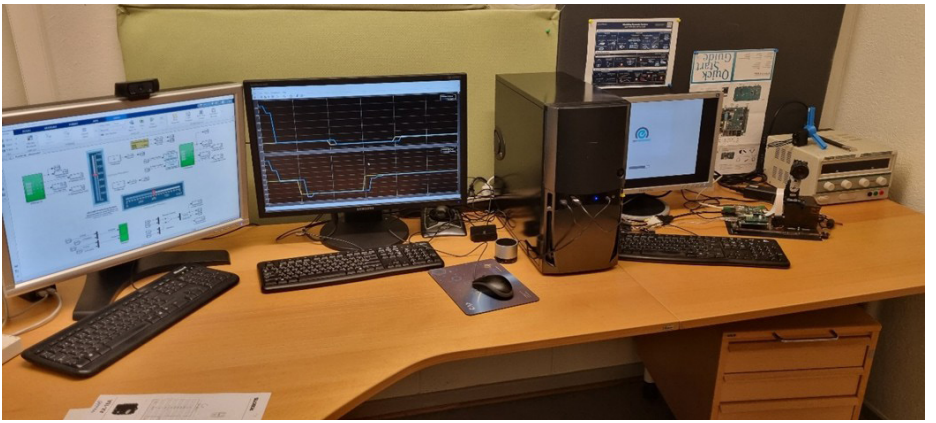
The project aims to improve EEG-based Brain Computer Interfaces (BCI) with machine learning, control, and cloud computing. A Brain-Computer Interface (BCI) is a system that, in real-time, translates the user's brain activity into commands that can be used to control applications, such as moving a cursor on the screen. The translation is made possible by machine learning methods and other algorithms. The thesis focuses on EEG-based BCIs which are the most common type of BCIs due to EEG measurements being non-invasive, having good temporal resolution, and being suitable for many applications. As of today, one of the biggest challenges for BCIs is the so-called calibration, which is necessary for the BCI to translate the user's brain activity correctly. The need for calibration comes from the variability of the brain signals over time and between users.

2DCAM — SUBSYSTEM FOR TWO-COORDINATE POSITIONING OF THE UAV AUXILIARY VIDEO CAMERA

Researcher: Voitenko, Volodymyr
Funding: Crafoord Foundation and SAR-Sweden (Scholars At Risk Sweden)

Unmanned aerial vehicles (UAVs) are used to surveil ground objects in many areas. UAVs deliver a video stream from an on-board video camera, which is normally read by an operator. Despite the successful attempts to expand the UAV autonomy, human operators remain important. They experience heavy information loads leading to omission of desired objects, fatigue, and diseases. Using an auxiliary video camera with a narrow viewing angle positioned independently of the main camera is a proposed solution to this problem. The 2DCAM project aims to develop theoretical foundations, software and hardware, and to experimentally verify the quasi-optimal positioning subsystem for the auxiliary video camera of the UAV based on the data from an on-board object detector. The project integrates knowledge from image processing, automatic control systems and mechatronics. Quasi-optimal controller empowers AI and changes the design paradigm of electromechanical systems.

To solve the problem of fatigue of the UAV operator during long-term search and reconnaissance missions, a research hardware and software complex was created, in which the positioning of the additional UAV video camera with a narrow field of view is carried out. Dynamixel Library for MATLAB and Simulink was used to organize the interaction of actuators with the virtual environment, which allows combining positioning and image analysis subsystems in a single virtual environment. The results of an experimental study of the 2DCAM virtual-physical system are given.



Software and hardware complex for experimental study of t
wo-coordinate positioning system of additional UAV video camera

UAVIPOD — IMAGE PRE-PROCESSING AND OBJECT DETECTING UAV SYSTEM

Researchers: Voitenko, Volodymyr; Olofsson, Björn
Funding: Crafoord Foundation

The UAVIPOD project addresses cognitive overload in UAV operators by using an onboard object detector to pre-analyze images from the Main Navigation Camera. This data then guides an Additional Video Camera (AVC) with a narrow field of view. When a potential object of interest is detected, the AVC is precisely positioned to capture a magnified image for verification by a human operator. The UAVIPOD project focuses on developing software and hardware for image processing using artificial intelligence (AI), culminating in experimental validation.

As an example, the pictures show images captured by the main and auxiliary cameras. Both cameras have the same resolution; however, the field of view of the auxiliary camera is eight times narrower than that of the main camera. It is evident that detecting a person standing to the right of a vehicle is significantly easier in the right-hand image, which was captured by the auxiliary camera

Comparison of images from the main and auxiliary cameras

FORCE CONTROL FOR ROBOTIC MANIPULATION WITH EXTRINSIC DEXTERITY

Researchers: Kovács, Rasmus; Karayiannidis, Yiannis; Olofsson, Björn
Funding: WASP

This project focuses on force control for robotic manipulation with extrinsic dexterity, aiming to enable reliable object handling using simple parallel grippers. Instead of relying on complex hands, the approach exploits controlled interaction and contact forces to manipulate objects.

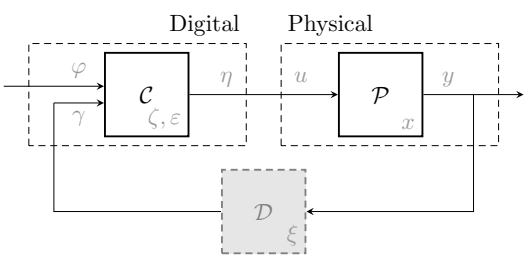
The work concentrates on grasp-force regulation, where an inner control loop ensures accurate force tracking despite uncertain contact conditions. The controller is designed to follow force trajectories computed online and adapt to unknown object and contact properties. Current efforts involve simulation-based evaluation of different force control strategies and parameter adaptation methods, using simplified dynamic models to study robustness and performance.

INTELLIGENT CLOUD ROBOTICS FOR REAL-TIME MANIPULATION AT SCALE

Researchers: Maggio, Martina; Sinnema, Yde
Funding: WASP

Autonomous robotic systems that can reliably grasp and manipulate objects in their environment in order to perform complex tasks "in the wild" have been the goal of robotic manipulation research for decades, promising breakthrough productivity and safety improvements to industrialized and aging societies with potential applications ranging from industrial automation to robotic health- and elderly care and personal robotic assistants. While approximately 2.7 million industrial robotic systems are estimated to be in operation worldwide as of 2020, these systems currently do not yet benefit from a network effect at scale as they are mostly manually programmed and do not share information or learn collaboratively in a large scale data-driven manner. As a result, the predominant industrial robotic manipulation applications are still very limited to specific tasks in controlled environments such as industrial welding, pick-and place and palletizing tasks.

Recent progress in machine learning applications, particularly in fields such as speech recognition and computer vision, have been powered by a confluence of factors chiefly related to developing systems at scale. In particular, performance breakthroughs have been enabled by scalable machine learning algorithms, large scale training data collection and processing and cloud computation that enables dynamic resource allocation depending on the machine learning task requirements.



In this interdisciplinary project spanning machine learning, robotics, cloud-computing and real-time control, we focus on achieving a breakthrough in the foundational algorithms, machine learning and system design requirements for scaling networked, distributed, robotic manipulation systems to a large network of cloud-connected robots. We envision this network to continuously collect very large scale manipulation training data and to dynamically learn from past experience using federated machine learning. Our approach will allow robots to balance between centralized machine learning in the cloud and local processing of information using the computational resources of each individual robot while incorporating real-time control and network bandwidth constraints.

Our consortium proposes to pioneer this emerging paradigm of cloud robotics using a robotic demonstrator system featuring a large number of low cost miniature robotic arm systems connected to remote cloud computing resources. The final scale of this system is envisioned to reach approximately 100 low-cost robotic arms that will operate in parallel as well as an initial demonstration of our approach on a smaller set of available higher precision ABB Yumi robots. We will utilize our demonstrator system to study fundamental research challenges, including questions about the foundational data requirements of machine learning methodologies in the robotic manipulation context, the development of federated machine learning methodologies in a cloud-edge network of robots, resource management, and the development of rigorous large scale experiment design, testing and real-time control strategies for data-driven robotic manipulation at previously unseen levels of network-orchestrated parallelism.

DATA-DRIVEN MODELING FOR SUSTAINABLE MINING

Researchers: Norlund, Frida; Soltesz, Kristian; Eker, Johan; Bauer, Margret
Funding: WASP

Flotation is the dominating process in the global copper, lead, and zinc mining industries to separate valuable minerals from waste material. In the upstream process steps, the ore is ground to liberate all mineral grains, and mixed with water to form a slurry. In flotation, chemical reagents are added to improve the hydrophobic properties of selected minerals. When air is added, these minerals follow the air bubbles to the surface and can be extracted in the resulting froth, forming a concentrate. This process is implemented in flotation tanks interconnected in a complex circuit that often includes re-grinding and recirculation. Floatation is a pivotal process step, as it defines the recovery (yield), which has a proportional impact on both environmental aspects and the financial result of the company.

Today, the flotation process is typically controlled semi-manually, where simple control loops stabilize tank levels and flow rates, while operators adjust parameters like airflow, reagent- and lime- addition based on the available measurements and experience. Model predictive control solutions have been attempted, with some success. However, performance is severely limited by poor model accuracy and the inability to adapt to changes in ore properties as new areas of the mine are excavated. To increase efficiency and autonomy of mineral processing, these challenges must be addressed.

Therefore, this PhD project addresses modeling of the flotation process for control purposes. Data-driven modeling through machine learning (ML) techniques holds great potential, but several aspects must be addressed before it can be applied in an industrial setting. In our setting, observation of a process is limited by physical restrictions and the available measurement technology. Furthermore, the effect of the measured properties on the system state are often both complicated and only known conceptually, making the interpretation of the measurements challenging. To use the limited data that is available efficiently, we will combine

Photo of the flotation series in the Aitik concentrator, located near Gällivare, Sweden. Photo credit: Jonas Westling.

machine learning with physics-based modeling, avoiding wasting scarce data on learning known laws of physics.

In this project, we will therefore push the state-of-the-art within mining process control by complementing machine learning with physics-based models based on e.g., conservation laws.

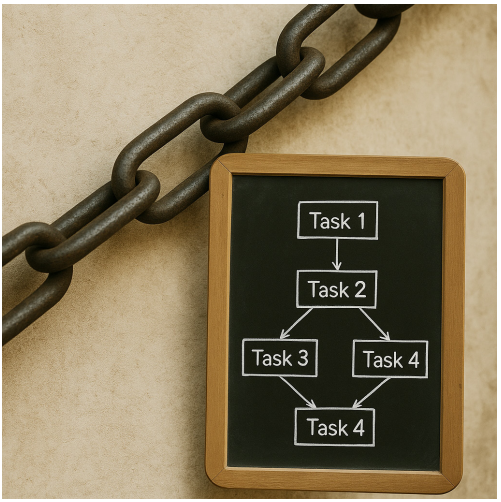
We firmly believe that the future of floatation control, and indeed many associated process steps, lies in incorporating informal operator know-how into dynamical models, to enable model-based control solutions, where traditional data-driven paradigms suffer from lack of informative data. This physics-informed machine learning approach to increased autonomy is becoming increasingly feasible thanks to advances within scientific machine learning methodology. Within mining and the process industries, embracing it will provide the opportunity to increase efficiency of resource utilization, thereby enabling the transition to a sustainable technological future.

TRUSTWORTHY CYBER-PHYSICAL PIPELINES

Researcher: Maggio, Martina
Funding: Swedish Research Council (VR)

Pipelines of tasks are ubiquitous. From automotive to avionics, a standard pattern for processing data and take decision is to read some input (possibly measuring some environmental variable), process the data, and the write to the output (possibly by actuating over the external environment). When these pipelines operate in a safety critical environment, the assurance of a correct functioning is of vital (in the true meaning of the term) importance. However, a correct prediction of delivery is not easy.

As an example of the jeopardy of the problem, in 2021 NASA reported an anomaly during the sixth flight of the Ingenuity helicopter of the Mars Perseverance rover. While in the air, Ingenuity began adjusting its velocity and tilting back and forth in an oscillating pattern. Ingenuity used a pipeline of sensor data, that include inertial measurement units and cameras to estimate its position.



Quoting from the report: "Approximately 54 seconds into the flight, a glitch occurred in the pipeline of images being delivered by the navigation camera. This glitch caused a single image to be lost, but more importantly, it resulted in all later navigation images being delivered with inaccurate timestamps. From this point on, each time the navigation algorithm performed a correction based on a navigation image, it was operating on the basis of incorrect information about when the image was taken. The resulting inconsistencies significantly degraded the information used to fly the helicopter, leading to estimates being constantly corrected to account for phantom errors. Large oscillations ensued."

In the project, we work on verification techniques for cyber-physical systems and make them available through open source tools. The basic research behind the project requires a significant innovation that is far from obvious to establish, because of the intertwining of discrete and continuous dynamics, as well as involving the timing of the computations.

HISTORICAL FEMALE INFLUENCERS IN AUTOMATIC CONTROL

Researchers: Johnsson, Charlotta; Westin, Eva; Hägglund, Tore; Soltesz, Kristian; Bauer, Margret
Funding: IFAC Activity Fund, Deptartment of Automatic Control, ELLIIT, IEEE Outreach Fund

The aim of this initiative is to gather a collection of portraits of women who worked in control engineering over the decades and left their mark. The purpose is to document their role and importance in the field of control engineering and to highlight the role of women for today's students and professionals.

The project has identified early female historical influencers (retired or emeritus female professionals) who have served as role models in the field of automatic control.

The portraits of these women can be used in various outreach material such as e.g. lecture notes, and other inspirational material for young and potential future control professionals. With this project we hope to inspire more females to enter the community of Automatic control

During 2025, the project was presented, both orally and in exhibitions, at several national and international conferences.

Françoise Lamnabhi-Lagarrigue

FUTURE FEMALE INFLUENCERS IN AUTOMATIC CONTROL

Researchers: Johnsson, Charlotta; Westin, Eva; Bauer, Margret
Funding: IEEE Outreach Fund

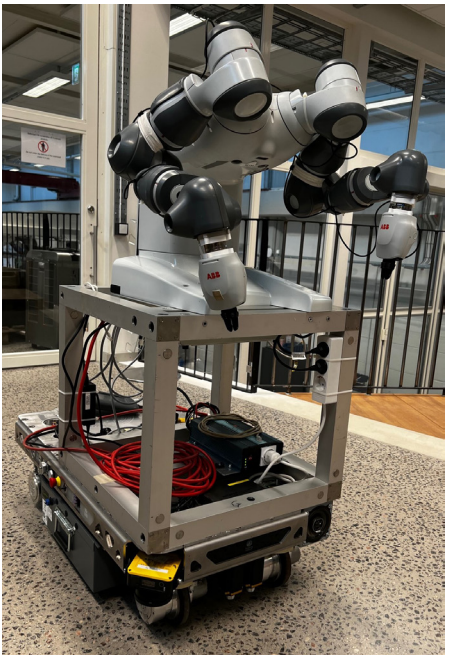
The aim of this initiative is to look ahead and investigate the hopes, wishes, ideas and aspirations of young female students and professionals. For this purpose, a questionnaire to capture the voices of future female control engineers, has been designed. Assuming that the field of automatic control will be as relevant in the future as it is today, it is of interest to know how young people believe the field should evolve and what they are hoping for. The answers will be artistically collated and not linked to individuals.

TASK CENTRIC WHOLE-BODY COMPLIANT ROBOT CONTROL

Researchers: Fregnan, Sebastiano; Karayiannidis, Yiannis; Olofsson, Björn
Funding: WASP WARA-Robotics

A mobile manipulator combines the unlimited workspace of a mobile platform with the multiple functionalities of a manipulator, thus providing a flexible system that have the potential to revolutionize various industries, including logistics, manufacturing, construction, and search-and-rescue operations. Despite the enormous potential for a wide range of industries and recent advances in mobile manipulation, there are several challenges that impede the widespread adoption of mobile manipulators. Besides, for the majority of mobile manipulators deployed in industrial floors and academic labs, the mobility of the platform and the manipulator are not treated in a whole-body fashion, i.e., the mobile robot moves to specific positions while the manipulator is not moving and when the manipulator performs a task the platform remains still. To achieve the full potential of mobile manipulation, the simultaneous motion and interaction of the platform and the arm needs to be considered.

The key idea of the PhD project is to endow mobile manipulators with whole-body mobility and interaction functionalities that are based on coordinated control of the mobile platform and the mounted robotic manipulator and address performance, reliability, and safety. The main objective of the project is to establish a constrained control framework for composite platform-manipulator motion and design adaptive whole-body compliant control for interaction with objects and the environment. The main platform designed to be used in the project is an ABB YuMi robot mounted on Sleipner, a mobile robot of the RobotLab LTH.



CAISA - COLLABORATIVE ARTIFICIAL INTELLIGENT SURGICAL ASSISTANT

Researchers: Stenmark, Maj; Johnsson, Charlotta in collaborations with Cognibotics and Skåne University Hospital
Funding: Swedish Government Agency for Innovation Systems (Vinnova)

In a multidisciplinary close collaboration (of surgeons, nurses, and experts in AI and Robotic Control) we want to begin the transfer of surgical know-how (both cognitive and manual) from human to machine, build a prototype, demonstrate proof-of-concept and drive the development in the direction of safe and autonomous surgical robotics.

To replace the human surgeons, we need Advanced Robotic Control. For surgical purposes, this control must be based on short (<200 ms) loops of Sense-Plan-Act.

For sense, Computer Vision, specifically 6D OPE algorithms will be used to map all relevant physical objects, including patient anatomy, surgical equipment, and operating theatre staff.

For plan, Reinforced Learning will be applied. Expert surgeons will annotate good vs bad plans for a given trajectory of motions at a given situation.

For act, Dynamic Movement Primitive algorithms will be applied to capture, copy and smoothen surgical motions from segmentations by 6D OPE. Transformer models are an alternatives that will explored, but will requiew larger datasets.

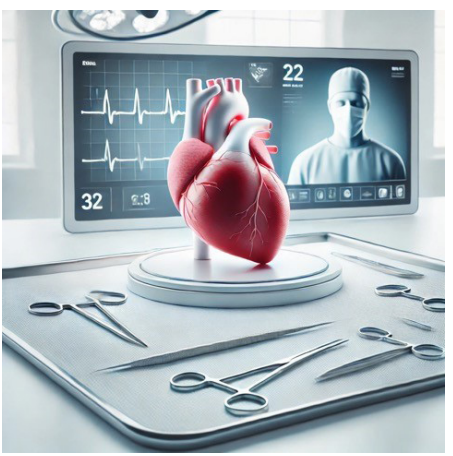
For these innovations to reach clinical use, reliable human-machine communication protocol must be developed. The robot system must visualize, by means of a laser marker or projected lines on to the surgical field to describe the planned trajectory of cut, suturing or other actions.

FUNCTIONAL EX VIVO HEART EVALUATION

Researchers: Soltesz, Kristian; Pigot, Henry; Steen, Erik; Nilsson, Johan, AIBCTS
Funding: Mats Paulssons Foundation and Hjelm Family Foundation

In this project we conceptualize, develop and refine a cyber-physical device that emulates vascular dynamics. It is connected to an isolated heart, and enables evaluation of the organ outside of the body, under user-specified work load conditions.

Together with clinical and corporate research collaborators, we adapt the technology to the clinical setting.



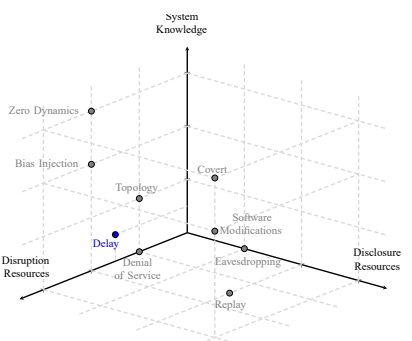
DYNAMIC ATTACK DETECTION AND MITIGATION FOR SECURE AUTONOMY

Researcher: Maggio, Martina in collaboration with KTH Royal Institute of Technology and Linköping University
Funding: WASP-NEST

Cyber attacks targeting control systems are a relatively recent phenomenon, but several incidents in the past decade have clearly demonstrated their devastating impact. An essential difference compared to cyber attacks on regular IT-systems is that attacks on control systems have an impact on the physical world. This means that they have the potential to harm humans or cause damage to the environment. A second fundamental difference concerns the possibilities to defend against these attacks. Control systems are designed (by means of feedback and feed-forward mechanisms) to make physical systems, such as drones and autonomous vehicles, behave as desired, even in the presence of natural uncertainty and disturbances and varying operator commands. Safety considerations are vital, and minimizing computational time and complexity are the norm. Yet, few control systems are designed to cope with the threat of adversarial attacks, targeting software and communication signals. Furthermore, control platforms and infrastructures rarely adopt state-of-the-art network security protocols that would enforce cryptographic authentication and encryption. Our challenge is to design protection mechanisms for control systems that can gracefully handle adversarial activities, and ensure the desired control performance and safety.

In DYNACON-NEST, four leading research groups in cyber-physical security (control systems, real-time systems, communication, and network security) at KTH, Lund University, and Linköping University join forces to address these challenges in the context of autonomous systems. More specifically, the group will tackle research challenges related to the injection of false data and manipulation of timestamps in time-critical control loops. This is achieved by adaptively enabling the use of trusted embedded devices and (limited) cryptographic authentication when necessary. Furthermore, distributed anomaly detection and state observer schemes are developed to handle adversarial attacks both in the local and in the supervisory control loops. This is achieved by a novel combination of model-based and machine learning techniques. As a use case, we consider swarms of unmanned aerial vehicles (drones). A particularly relevant scenario is that of "identity theft", where malicious identity signals are exploited by attackers to deceive the control system operators.

DYNACON-NEST will also be the foundation for a new WASP hotspot in cyber-physical security. We will foster an active academic environment focusing on cybersecurity in physical, safety-critical systems. We will leverage industry interest (Bitcraze, Combitech, Ericsson, Saab) and engage with international colleagues (Imperial College, New York University) in annual workshops, that will facilitate interactions between WASP researchers, PhD students, leading scientists, and industry experts.



The figure represents a taxonomy of attacks, and positions our attack, the delay attack. The attacker ensures that the controller calculations are not completed on time, in an attempt to maximize the disruption that the system experiences

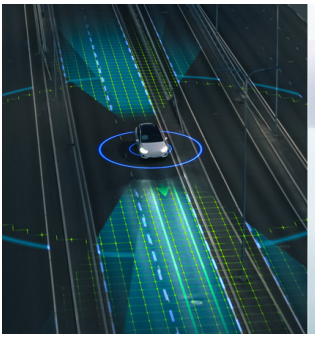
NEXTG2COM

Researchers: Johnsson, Charlotta in collaboration with researchers at the Faculty of Engineering at Lund University
Funding: Vinnova in the Avancerad Digitalisering program, and The Faculty of Engineering at Lund University, Volvo Cars, Tetra Pak, Ericsson, Sony, Region Skåne, Acconeer AB, Allicon AB, Bosch, CodeScene, Cognibotics, GUARDBOT INC, RemotiveLabs, Sensative, Swedish Sea Rescue Society, and u-blox.

The new competence center on Next Generation Communication and Computing Infrastructures and Applications (NextG2Com) is now up and running after the kick-off May 30 at The Faculty of Engineering at Lund University in Teknodromen.

The 16 partners from academia, industry and the public sector spent a full day getting an introduction to the center and discussing the collaborative research and innovation program, organized in six themes, ranging from wireless communication to software and data. We plan for five years of research and set out for 10. The first step is to recruit five PhD students.

Our vision is to set a distinct footprint in the design of next generation communication and computational infrastructures and applications, nationally and internationally. In particular, we will focus on the interplay between infrastructure and applications, and developments driven by and needed for machine learning (ML) advancements. Through integrated industry–academia research we will advance infrastructure technologies and design methodologies, communicate knowledge into industry practice through proof-of-concepts, demonstrators and targeted outreach, and we will strengthen basic and advanced education.

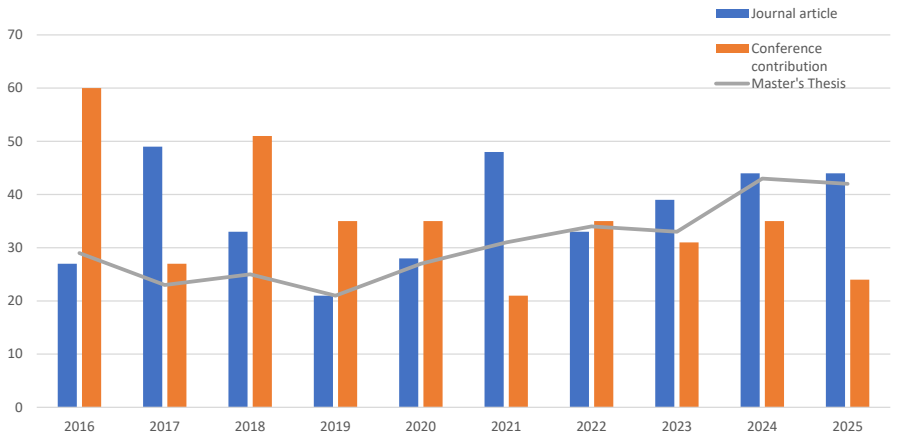


Publications and seminars

This chapter contains a list of publications and seminars during 2025

PUBLICATIONS 2025

You can find references to all the publications on www.control.lth.se/publications and almost all of them can be downloaded from this site. Any of the reports may, however, also be borrowed through the library service.



BOOK CHAPTERS

Karayiannidis, Yiannis; *Stability and Lyapunov Theory*. Encyclopedia of Systems and Control Engineering (First Edition), p. p.98-109.

JOURNAL ARTICLES

Agner, Felix; Trabert, Ulrich; Rantzer, Anders and Orozaliev, Janybek; *A data-based comparison of methods for reducing the peak flow rate in a district heating system*. In Smart Energy 17.

Alutto, Martina; Cianfanelli, Leonardo; Como, Giacomo and Fagnani, Fabio; *On the Dynamic Behavior of the Network SIR Epidemic Model*. In IEEE Transactions on Control of Network Systems 12(1). p.177-189.

Arslan Waltersson, Gabriel and Karayiannidis, Yiannis; *Perception, control, and hardware for in-hand slip-aware object manipulation with parallel grippers*. In International Journal of Robotics Research.

Banert, Sebastian; Upadhyaya, Manu and Giselsson, Pontus; *The Chambolle–Pock method converges weakly with $\theta > 1/2$ and $\tau\sigma\|L\|2 < 4/(1 + 2\theta)$*. In Optimization Letters.

Bencherki, Fethi; Türkay, Semiha and Akçay, Hüseyin; *Observer-based switched-linear system identification*. In Nonlinear Analysis: Hybrid Systems 58.

Berner, Tommi; Nyberg Carlsson, Max; Ruuskanen, Johan; Maggio, Martina and Årzén, Karl Erik; *Improved dynamic modeling for controlled server queues*. In Control Engineering Practice 164.

Caparroz, Malena; Soltesz, Kristian; Hägglund, Tore; Guzmán, José Luis and Berenguel, Manuel; *A new approach to relay-based autotuning PID controllers and their evaluation in pH control of industrial photobioreactors*. In Control Engineering Practice 164.

Catalano, Costanza; Castaldo, Maria; Como, Giacomo and Fagnani, Fabio; *On a Network Centrality Maximization Game*. In Mathematics of Operations Research 50(3). p.2112-2140.

Cianfanelli, Leonardo and Como, Giacomo; *On the Stability of the Logit Dynamics in Population Games*. In IEEE Transactions on Automatic Control 70(9). p.5910-5925.

Dahlin, Albin and Karayiannidis, Yiannis; *Autonomous navigation with convergence guarantees in complex dynamic environments*. In Automatica 173.

Fantozzi, Italo C.; Olhager, Jan; Johnsson, Charlotta and Schiraldi, Massimiliano M.; *Guiding organizations in the digital era : Tools and metrics for success*. In International Journal of Engineering Business Management 17.

Freitag, Kilian; Karayiannidis, Yiannis; Zbinden, Jan and Laezza, Rita; *Fine-tuning Myoelectric Control through Reinforcement Learning in a Game Environment*. In IEEE Transactions on Biomedical Engineering.

Gallant, Melanie; Mark, Christoph; Pazzaglia, Paolo; von Keler, Johannes; Beermann, Laura; Schmidt, Kevin and Maggio, Martina; *Soft-Constrained Stochastic MPC of Markov Jump Linear Systems : Application to Real-Time Control With Deadline Overruns*. In IEEE Control Systems Letters 9. p.1532-1537.

Gurpegui Ramón, Alba; Jeeninga, Mark; Tegling, Emma and Rantzer, Anders; *Linear Regulator-based synchronization of positive discrete-time multi-agent systems*. In IFAC Proceedings Volumes (IFAC-PapersOnline) 59. p.19-24.

Hansson, Jonas and Tegling, Emma; *Closed-loop design for scalable performance of vehicular formations*. In IEEE Transactions on Control of Network Systems.

Hansson, Jonas and Tegling, Emma; *Compositional design for time-varying and nonlinear coordination*. In arXiv.org.

Heskebeck, Frida; Tufvesson, Pex and Hällström, Ask; *Student usage of Lund University Pole-Zero Explorer interactive tool in automatic control teaching*. In European Journal of Control 86.

Johansson, Rolf; *Model-Based State Estimation for Euler–Lagrange Systems and Rigid-Body Robot Control*. In Automatica 172.

Li, Yuling; Li, Chenxi; Liu, Kun; Dong, Jie and Johansson, Rolf; *Event-Triggered Control and Communication for Single-Master Multislave Teleoperation Systems With Try-Once-Discard Protocol*. In IEEE Transactions on Cybernetics.

Mandrioli, Claudio; Carlsson, Max Nyberg and Maggio, Martina; *Testing Abstractions for Cyber-Physical Control Systems—RCR Report*. In ACM Transactions on Software Engineering and Methodology 35(1).

Mandrioli, Claudio; Shin, Seung Yeob; Maggio, Martina; Bianculli, Domenico and Briand, Lionel; *Stress Testing Control Loops in Cyber-Physical Systems—RCR Report*. In ACM Transactions on Software Engineering and Methodology 34(8).

Min, Hancheng; Pates, Richard and Mallada, Enrique; *A frequency domain analysis of slow coherency in networked systems*. In Automatica 174.

Mogensen, Søren Wengel; *Weak equivalence of local independence graphs*. In Bernoulli 31(4). p.2772-2798.

Mollerstedt, Erik and Bernhardsson, Bo; *Out of Control Because of Harmonics : An Analysis of the Harmonic Response of an Inverter Locomotive [25 Years Ago]*. In IEEE Control Systems 45(4). p.10-19.

Morin, Martin and Giselsson, Pontus; *Sampling and Update Frequencies in Proximal Variance-Reduced Stochastic Gradient Methods*. In Journal of Optimization Theory and Applications 205(3).

Nilsson, Max and Giselsson, Pontus; *The symmetry coefficient of positively homogeneous functions*. In Optimization Letters.

Norlund, Frida; Soltesz, Kristian and Bauer, Margret; *Comparison of industrial controllers: Disturbance rejection in an up-and-running industrial flotation process*. In Journal of Process Control 152.

Ohlin, David; Pates, Richard and Arcak, Murat; *On Exact Solutions to the Linear Bellman Equation*. In IEEE Control Systems Letters 9. p.1568-1573.

Raeiszadeh, Mahsa; Estrada-Solano, Felipe; Glitho, Roch; Eker, Johan and Mini, Raquel; *ALogSCAN: A Self-Supervised Dual Network for Adaptive and Timely Log Anomaly Detection in Clouds*. In IEEE Transactions on Cognitive Communications and Networking.

Rask, Josef; Fransson, Per-Anders; Johansson, Rolf; Magnusson, Måns and Tjernström, Fredrik; *Sensorimotor and Sex Influence on Spatial Orientation when Sitting and Standing*. In Perceptual and Motor Skills.

Salt Ducaju, Julian; Olofsson, Björn and Johansson, Rolf; *Model-Based Predictive Impedance Variation for Obstacle Avoidance in Safe Human–Robot Collaboration*. In IEEE Transactions on Automation Science and Engineering 22. p.9571-9583.

Sileo, Monica; Karayiannidis, Yiannis; Pierri, Francesco and Caccavale, Fabrizio; *A Novel Decentralized Leader–follower Control Scheme for Centroid and Formation Tracking*. In IEEE Transactions on Control of Network Systems 12(3). p.2040-2051.

Sridhar, Gautam; Boselli, Sofía; Skoglund, Martin A; Bernhardsson, Bo and Alickovic, Emina; *Improving auditory attention decoding in noisy environments for listeners with hearing impairment through contrastive learning*. In Journal of Neural Engineering 22(3).

Steen, Stig; Liao, Qiuming; Pascevivius, Audrius; Li, Mei and Steen, Erik; *Ex vivo resuscitation and evaluation of hearts after 22 minutes of normothermic cardiac arrest*. In Scandinavian Cardiovascular Journal 59(1).

Sundell, Jesper; Rekic, Dinko; Melin, Johanna; Johansson, Susanne; Ebrahimi, Ahmad; Dota, Corina and Parkinson, Joanna; *Concentration–QT modeling demonstrates that the selective mineralocorticoid receptor modulator, balcinrenone (AZD9977), does not prolong QT interval*. In CPT: Pharmacometrics and Systems Pharmacology 14(2). p.292-301.

Vladu, Emil and Rantzer, Anders; *A Cone-preserving Solution to a Nonsymmetric Riccati Equation*. In Linear Algebra and Its Applications 709. p.449-459.

Voytenko, Volodymyr and Pisarevskiy, Alexander; Remote design of safety controllers for industrial automation systems. In Technical Sciences and Technologies 3(41). p.401-409.

Wahlquist, Ylva; Paolino, Nicola; Schiavo, Michele; Visioli, Antonio and Soltesz, Kristian; *Kalman filter soft sensor to handle signal quality loss in closed-loop controlled anesthesia*. In Biomedical Signal Processing and Control 104.

Wijnbergen, Paul; Jeeninga, Mark; de Haan, Redmer and Lefeber, Erjen; *Longitudinal and lateral control of vehicle platoons : A unifying framework to prevent corner cutting*. In Automatica 177.

Wu, Dongjun; *Consensus of a Class of Nonlinear Systems With Varying Topology : A Hilbert Metric Approach*. In IEEE Transactions on Automatic Control 70(11). p.7572-7579.

Wu, Dongjun and Rantzer, Anders; *Duality-based Dynamical Optimal Transport of Discrete Time Systems*. In IEEE Transactions on Automatic Control.

Upadhyaya, Manu; Banert, Sebastian; Taylor, Adrien B. and Giselsson, Pontus; *Automated tight Lyapunov analysis for first-order methods*. In Mathematical Programming 209(1-2). p.133-170.

Zhou, Jian; Gao, Yulong; Johansson, Ola; Olofsson, Björn and Frisk, Erik; *Robust Predictive Motion Planning by Learning Obstacle Uncertainty*. In IEEE Transactions on Control Systems Technology 33(3). p.1006-1020.

Zhou, Jian; Gao, Yulong; Olofsson, Björn and Frisk, Erik; *Robust motion planning for autonomous vehicles based on environment and uncertainty-aware reachability prediction*. In Control Engineering Practice 160.

CONFERENCE CONTRIBUTIONS

Arslan Waltersson, Gabriel and Karayiannidis, Yiannis; *Friction Estimation for In-Hand Planar Motion*. 19th International Symposium on Experimental Robotics.

Balador, Ali; Ashjaei, Mohammad; Umar, Madiha; Al Bayati, Ahmed; Williams, Andrew; Mubeen, Saad; Mini, Raquel; Nilsson, Klas and Arzen, Karl Erik; *Towards a Framework for Dynamic Task Offloading in Real-Time Robotic Applications*. 30th IEEE International Conference on Emerging Technologies and Factory Automation, ETFA 2025.

Bencherki, Fethi and Rantzer, Anders; *Adaptive Control of Positive Systems with Application to Learning SSP*. 7th Annual Learning for Dynamics and Control Conference, p. 660-672.

Caparroz, Malena; Soltesz, Kristian; Hägglund, Tore; Guzmán, José Luis and Bernguel, Manuel; *A new approach to autotuning PID controllers*. Jornadas de Automática.

Carriero, Graziano; Sileo, Monica; Karayiannidis, Yiannis; Pierri, Francesco and Caccavale, Fabrizio; *Decentralized control of internal wrenches in a multi-manipulators object transportation task*. 2025 European Control Conference (ECC), p.705-710.

Dominguez, David Caceres; Iannotta, Marco; Kashyap, Abhishek; Sun, Shuo; Yang, Yuxuan; Cella, Christian; Colombo, Matteo; Pelosi, Martina; Preziosa, Giuseppe F.; Tafuro, Alessandra; Zappa, Isacco; Busch, Finn; Dong, Yifei; Longhini, Alberta; Lu, Haofei; Cabral Muchacho, Rafael I.; Styrud, Jonathan; Fregnan, Sebastiano; Guberina, Marko; Jia, Zheng; Carriero, Graziano; Lindqvist, Sofia; Castro, Silvio Di and Iovino, Matteo; *The First WARA Robotics Mobile Manipulation Challenge - Lessons Learned*. 12th European Conference on Mobile Robots, ECMR 2025.

Jia, Zheng; Karayiannidis, Yiannis and Olofsson, Björn; *Optimization-Based Path-Velocity Control for Time-Optimal Path Tracking under Uncertainties*. 2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025).

Jia, Zheng; Karayiannidis, Yiannis and Olofsson, Björn; *A Study of Task-Space Path-Velocity Control for Torque-Limited Redundant Manipulators under Uncertainties*. 2025 European Control Conference (ECC) p. 2894-2900.

Manten, Georg; Casolo, Cecilia; Ferrucci, Emilio; Mogensen, Søren Wengel; Salvi, Cristopher and Kilbertus, Niki; *Signature Kernel Conditional Independence Tests in Casual Discovery for Stochastic Processes*. In 13th International Conference on Learning Representations, ICLR 2025 p.62970-63006.

Nauta, Talitha; Sandberg, Henrik and Maggio, Martina; *Stealthy Computational Delay Attacks on Control Systems*. ICCPS '25: Proceedings of the ACM/IEEE 16th International Conference on Cyber-Physical Systems, article 9, p. 1-11.

Nyberg Carlsson, Max; Al Bayati, Ahmed and Årzén, Karl Erik; *Oversampling-Based Control with Multi-Core and Edge Implementations*. 9th IEEE Conference on Control Technology and Applications, CCTA 2025 p.812-819.

Paolino, Nicola; Norlund, Frida; Schiavo, Michele; Visioli, Antonio and Soltesz, Kristian; Adjusting aggressiveness of Depth-of-Hypnosis PID control by MPC-based feedforward. The 2025 American Control Conference (ACC), p. 3987 - 3992.

Pechorkin, Yaroslav and Voytenko, Volodymyr; *A small-sized information display system for entering a flight task to an unmanned aerial vehicle*. V International Scientific and Practical Conference "Novel Technologies of Smart Society" p.58-59.

Pechorkin, Yaroslav and Voytenko, Volodymyr; *Practical Implementation of Object Tracking Function for UAV Computer Vision System*. International Scientific and Practical Conference of Students, Postgraduates and Young Scientists p.1021-1022.

Rantzer, Anders; *On Minimax Optimal Dual Control for Fully Actuated Systems*. 2025 American Control Conference, ACC 2025 In Proceedings of the American Control Conference p.3993-3997.

Sinnema, Yde and Maggio, Martina; *Analysis of Control Systems Under Sensor Timing Misalignments*. 2025 IEEE 31st Real-Time and Embedded Technology and Applications Symposium (RTAS), p. 137-150.

Solodchuk, Maksym and Voytenko, Volodymyr; *Software and hardware complex 2DCAM for physical simulation of two-coordinate positioning system of additional UAV video camera*. V International Scientific and Practical Conference "Novel Technologies of Smart Society" p.122-123.

Sukleta, Dmytro and Voytenko, Volodymyr; *Prototype Object Detector for an Unmanned Aerial Vehicle*. International Scientific and Practical Conference of Students, Postgraduates and Young Scientists p.1001-1002.

Voytenko, Volodymyr; Solodchuk, Maksym and Denisov, Yuriy; *Simulation of the Two-Coordinate Positioning System of the UAV Auxiliary Video Camera.* In Lecture Notes in Networks and Systems p.434-446.

Wahlquist, Ylva and Soltesz, Kristian; *Seamless integration of target-controlled infusion and closed-loop anesthesia*. The 2025 American Control Conference (ACC), p. 674 - 679.

Wang, Jinyi; Kucher, Kostiantyn; Pates, Richard and Kerren, Andreas; *EuroEnergyVis : Interactive Visualization of Power Plant Data for European Countries*. 18th International Symposium on Visual Information Communication and Interaction, VINCI 2025 In 18th International Symposium on Visual Information Communication and Interaction, VINCI 2025.

Wang, Shumo; Bini, Enrico; Deng, Qingxu and Maggio, Martina; Jitter Propagation in Task Chains. 2025 IEEE Real-Time Systems Symposium (RTSS).

Westny, Theodor; Olofsson, Björn and Frisk, Erik; *Toward Unified Practices in Trajectory Prediction Research on Bird's-Eye-View Datasets*. 36th IEEE Intelligent Vehicles Symposium, IV 2025 In IEEE Intelligent Vehicles Symposium, Proceedings p.83-89.

Wu, Dongjun and Lin, Yankai; *Indirect Approach to Mixed-Integer Optimal Control.* 37th Chinese Control and Decision Conference, CCDC 2025 p.6592-6596.

PHD THESES

Agner, Felix*; Control of Capacity-Constrained Networks*. PhD Thesis, Department of Automatic Control, Lund University, Sweden, January 2025.

Hansson, Jonas; *Scalable Control Design for Networked Systems : Coordination Through Local Co-operation.* PhD Thesis, Department of Automatic Control, Lund University, Sweden, June 2025.

Tufvesson, Pex; *Real-Time Brain-Computer Interfaces*. PhD Thesis, Department of Automatic Control, Lund University, Sweden, November 2025.

Upadhyaya, Manu; *Lyapunov analyses for first-order methods : Theory, automation, and algorithm design*. PhD Thesis, Department of Automatic Control, Lund University, Sweden, September 2025.

Vladu, Emil; *On Performance Guarantees for Systems with Conic Constraints.* PhD Thesis, Department of Automatic Control, Lund University, Sweden, March 2025.

Wahlquist, Ylva; *Modeling and Control of Pharmacological Systems*. PhD Thesis, Department of Automatic Control, Lund University, Sweden, March 2025.

LICENTIATE THESES

Bencherki, Fethi; *Adaptive Control of Positive Systems*. Licentiate Thesis, Department of Automatic Control, Lund Univeristy, Sweden, February 2025.

Gurpegui Ramón, Alba; *Minimax Linear Regulator Problems for Positive Systems : with applications to multi-agent synchronization.* Licentiate Thesis, Department of Automatic Control, Lund Univeristy, Sweden, February 2025.

TECHNICAL REPORT

Rasmusson, Monika; Olofsson, Björn (Eds); *Activity Report 2024, Automatic Control Lund University.* Technical Report, Department of Automatic Control, Lund University, Sweden, April 2025.

MASTER THESES

Ahlgren, Sara; *Adaptive and Robust Control Schemes in Electric Power Systems*. Master's thesis TFRT-6289. Supervisors: Hansson, Erik (external); Soltesz, Kristian and Pates, Richard, , Department of Automatic Control, Lund University.

Anderberg Törngren, Theodor; *Using Similarity to Accelerate the Primal-Dual Hybrid Gradient Algorithm for Linear Programming*. Master's thesis TFRT-6273. Supervisors: Giselsson, Pontus and Bernhardson, Bo, Department of Automatic Control, Lund University.

Annedotter, Alexandra and Unosson, Oscar; *Coordinated Load Attacks on Modern Distribution Grids: Modelling and Simulation on a European Medium Voltage Grid with Droop Controlled DERs*. Master's thesis TFRT-6304. Supervisors: Tegling, Emma and Pates, Richard, , Department of Automatic Control, Lund University.

Bergström, Sanna and Ekre, Fremja; *Classification of Age-Related Hearing Loss using Conversational Speech Biomarkers*. Master's thesis TFRT-6266. Supervisors: Alickovic, Emina; and Skoglund, Martin (external); Bernhardsson, Bo and Giselsson, Pontus, Department of Automatic Control, Lund University.

Christensson, Lukas; *Machine Learning for Air Charge Estimation: A Residual Error Approach*. Master's thesis TFRT-6301. Supervisors: Alfredsson, Samuel (external); Gurpegui Ramón, Alba and Bernhardsson, Bo, Department of Automatic Control, Lund University.

Cohen Tillberg, Meja and Ingerskog, Ida; *Modelling flow in hydrocyclones using physics-informed neural networks*. Master's thesis TFRT-6268. Supervisors: Ulrich, Kenneth (external); Bernhardsson, Bo and Rantzer, Anders, Department of Automatic Control, Lund University.

Feltenmark, Fabian; *Applying and Proving Suitable Planning Principles on RRT* for Autonomous Trucks*. Master's thesis TFRT-6285. Supervisors: Ismail, Ofa (external) Olofsson, Björn and Årzén, Karl-Erik, Department of Automatic Control, Lund University.

Fredriksson, Viktor; *Residential Load Disaggregation Using Deep Learning Methods*. Master's thesis TFRT-6294. Supervisors: Velut, Stephane (external); Pates, Richard and Rantzer, Anders, Department of Automatic Control, Lund University.

Furuhjelm, Johan and Larsson, Oliver; *Physical Human–Robot Interaction Using a Mobile Manipulator.* Master's thesis TFRT-6303. Supervisors: Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Forghani Eklund, Daniel; *6D Pose Estimation and Calibration for Autonomous On-Orbit Servicing using the OOS-SIM*. Master's thesis TFRT-6305. Supervisors: Ulmer, Maximilian and Reichert, Anne (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Golobov, Samuel and Nyberg, Louise; *Analyzing Propagation and Duration of Station-level Disturbances in the Railway Network*. Master's thesis TFRT-6272. Supervisors: Palmqvist, Carl-William, Jeeninga, Mark, Tegling, Emma, Como, Giacomo and Pates, Richard, Department of Automatic Control, Lund University.

Gustafsson, Tobias and Hansson, William; *A Machine Learning Approach to Enhancing Supplier Quality Risk Assessment*. Master's thesis TFRT-6274. Supervisors: Soltesz, Kristian and Giselsson, Pontus, Department of Automatic Control, Lund University.

Gyllenstierna, Christoffer and Ritseson, Victor; *Streamlining Data-Centric ML-Ops in the Integrated Control System at ESS*. Master's thesis TFRT-6278. Supervisors: Rathsman, Karin, Rose, Simon and Horvath, Attila (external); Eker, Johan and Bernhardsson, Bo, Department of Automatic Control, Lund University.

Haglund, Harald; *Visual Tracking for On-Orbit Robotic Manipulation*. Master's thesis TFRT-6300. Supervisors: Ulmer, Maximilian and Reichert, Anne (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Hübsch, Oskar and Horovitz, Simon; *Learning and Model Predictive Control Applied to Energy Optimization of Chiller Plants for Data Centers*. Master's thesis TFRT-6291. Supervisors: Åkesson, Johan, Linders, Viktor and Zhao, Junyu (external); Bernhardsson, Bo and Rantzer, Anders, Department of Automatic Control, Lund University.

Jakobsson, Jim; *Machine Learning for Mortality Risk Prediction: A Study on Cohort Data*. Master's thesis TFRT-6271. Supervisors: Hägg, Sara and Mostafaei, Shayan (external); Edén, Patrik, Rantzer, Anders and Bernhardsson, Bo, Department of Automatic Control, Lund University.

Johansson, Tobias and Khan, Ishaaq; *Enhancing a Log-analyzer with GraphRAG*. Master's thesis TFRT-6283. Supervisors: Johnsson, Fredrik (external); Eker, Johan and Årzén, Karl-Erik, Department of Automatic Control, Lund University.

Junqueira Perticarari, Guilherme; *An Investigation on the Feasibility of Multimodal Acoustophoretic Control*. Master's thesis TFRT-6295. Supervisors: Baasch, Tierry (external); Wu, Dongjun and Rantzer, Anders, Department of Automatic Control, Lund University.

Karlsson, Filip; *Robot Force/Motion Tracking and Estimation of Contact Geometric Parameters*. Master's thesis TFRT-6293. Supervisors: Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Kovács, Rasmus; *Modeling and Simulation with Interval Uncertainties in Julia*. Master's thesis TFRT-6282. Supervisors: Olhager, Philip (external); Olofsson, Björn and Årzén, Karl-Erik, Department of Automatic Control, Lund University.

Krés, Gustav; *Influencing Power System Dynamics with Active Filters*. Master's thesis TFRT-6279. Supervisors: Lundström, Nils (external); Pates, Richard and Rantzer, Anders, Department of Automatic Control, Lund University.

Kugelberg, Erik and Lennartsson, Victor; *Control strategies for high inertia servo systems*. Master's thesis TFRT-6281. Supervisors: Jovanovski, Daniel (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Küssner, Lennart; *On Fully Dynamic All Pairs Shortest Path in Sparse Digraphs*. Master's thesis TFRT-6275. Supervisors: Tegling, Emma and Como, Giacomo, , Department of Automatic Control, Lund University.

Lindgren, Axelina; *Modernisering av kärnkraft: Från analog till digital tryckreglering*. Master's thesis TFRT-6302. Supervisors: Svensson, Claes (external); Soltesz, Kristian and Bernhardson, Bo, Department of Automatic Control, Lund University.

Lindmark, Albin and Philipson, Sofia; *Model-Based Control for Optical Image Stabilization*. Master's thesis TFRT-6290. Supervisors: Jonsson, Peter and Nilsson, Dennis (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Liu, Yuyao; *Mobile Robot Manipulator Control for Interacting with 1-DoF Mechanisms*. Master's thesis TFRT-6299. Supervisors: Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Löwgren, Simon and Nabage, Ruqayyah; *Linguistic and Syllabic Embeddings as Predictors in Auditory Attention Decoding*. Master's thesis TFRT-6276. Supervisors: Alickovic, Emina and Skoglund, Martin (external); Bernhardsson, Bo and Giselsson, Pontus, Department of Automatic Control, Lund University.

Meledin, Leonid; *Comparing Gradient-Based and Sampling-Based Model Predictive Control for Autonomous Racing*. Master's thesis TFRT-6296. Supervisors: Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Melgar, Christian and Hemark, Felix; *Variable Resonance Frequency Identification in a Magnetic Track System*. Master's thesis TFRT-6292. Supervisors: Valdt, Peter (external); Johnsson, Charlotta and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Meurling, Johan; *Predictive Modeling for Filter Longevity in Recirculating Shower Systems*. Master's thesis TFRT-6287. Supervisors: Gros, Alfred and Gianolio, Mateo (external); Johnsson, Charlotta and Soltesz, Kristian, Department of Automatic Control, Lund University.

Müller, Josefine and Thulin, Cajsa; *Acoustic Degradation Affects Neural Measures of Speech Tracking and Understanding*. Master's thesis TFRT-6277. Supervisors: Alickovic, Emina, Eskelund, Kasper and Shahsavari Baboukani, Payam (external); Bernhardsson, Bo and Giselsson, Pontus, Department of Automatic Control, Lund University.

Nyberg, August; *Comparing Performance of Periodic and Event Driven Automation for Robotics*. Master's thesis TFRT-6264. Supervisors: Wallinius, Mattias (external); Johnsson, Charlotta and Årzén, Karl-Erik, Department of Automatic Control, Lund University.

Popov Wirén, Jakob Olof and Nordenram, Kasper; *Machine Learning for Anti-Poaching: Decision Tree Applications on the Savannah*. Master's thesis TFRT-6269. Supervisors: Bernhardsson, Bo and Soltesz, Kristian, Department of Automatic Control, Lund University.

Raveendran, Vishnu Pradheep; *Causal event processes and alarm analysis at the European Spallation Source*. Master's thesis TFRT-6267. Supervisors: Rathsman, Karin (external); Wengel Mogensen, Sören and Bernhardsson, Bo, Department of Automatic Control, Lund University.

Rehme, Louise; *Path-Planning Algorithms for a Levitating Planar Motion System*. Master's thesis TFRT-6270. Supervisors: Bengtsson, Anna (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Rönnlund, Moa; *Optimizing Photovoltaic Systems: KPI Analysis and SCADA Recommendations*. Master's thesis TFRT-6265. Supervisors: Vikstrand, Johan and Kvist, Markus (external); Johnsson, Charlotta and Årzén, Karl-Erik, Department of Automatic Control, Lund University.

Rydén, Karl; *Graph-Neural-Network-Based Combinatorial Optimization under Natural Language Soft Constraints*. Master's thesis TFRT-6284. Supervisors: Perez, Daniel (external); Tegler, Erik; Giselsson, Pontus and Tegling, Emma, Department of Automatic Control, Lund University.

Stenström, Adam and Cederberg, Nils; *Scalable Optimization of Product Category Embeddings Using Multi-Dimensional Scaling and LLM Embeddings*. Master's thesis TFRT-6280. Supervisors: Paraschakis, Dimitrisand and Ros, Rasmus (external); Eker, Johan and Giselsson, Pontus, Department of Automatic Control, Lund University.

Stjernfeldt, Timothy and Ulmestrand, Clara; *Vision-Based Feedback Control for High-Precision Beam Alignment using a Robotic Arm at ESS*. Master's thesis TFRT-6298. Supervisors: Rathsman, Karin and Bry's, Thomasz (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Svanlund Hällsson, William and Öström, Nanna; *Deviation Detection in Dual Motor-Driven Industrial Doors*. Master's thesis TFRT-6297. Supervisors: Löfgren, Anders; Björk, Markus and Saran, Adem (external); Olofsson, Björn and Karayiannidis, Yiannis, Department of Automatic Control, Lund University.

Utsi, Joel; *Alarm Philosophy and Novelty Detection for the ESS Fast Beam Interlock System*. Master's thesis TFRT-6288. Supervisors: Nordt, Annika and Pavinato, Stefano (external); Pates, Richard and Bernhardsson, Bo, Department of Automatic Control, Lund University.

Wisth, Jakob; *Design and Implementation of a Web-Based Simulator for Automatic Control Education.* Master's thesis TFRT-6286. Supervisors: Bernhardsson, Bo and Olofsson, Björn, Department of Automatic Control, Lund University.

BACHELOR THESIS

Jacobsson, Måns; *Modelling and Forecasting of Electrical and Thermal Energy Units for a MPC based Home Energy Management System*. Bachelor degree TFRT-7670. Supervisors: Adlercreutz, Julia and Pates, Richard, Department of Automatic Control, Lund University.

Svenningsson, Axel; *Novel Applications of Machine Learning to Guide Diagnosis of Endocarditis*. Bachelor degree TFRT-7672. Supervisors: Ohlsson, Mattias, Rasmussen, Magnus; Bernhardsson, Bo, Department of Automatic Control, Lund University.

MISCELLANEOUS

Johnsson, Charlotta and Adenskog, Magnus; *The birth and growth of international innovation metropolitan areas – comparing the Bay Area and the 'Strait Area'*.

Johnsson, Charlotta; *Projects in Automatic Control Spring 2025*. TFRT-7673 Department of Automatic Control, Lund University.

SEMINARS AT THE DEPARTMENT

January

15 Master's Thesis Presentation: *Classification of age related hearing loss using conversational speech biomarkers*, Fremja Ekre, Sanna Bergström, LTH.
20 Master's Thesis Presentation: *Path Planning Algorithm for Levitating Planar Motion System*, Louise Rehme, LTH.
22 Master's Thesis Presentation: *Modelling flow in Hydrocyclones using physics-informed neural*, Meja Cohen Tillberg and Ida Ingerskog, LTH.
23 Seminar: *Enforcing contraction via data*, Claudio De Persis University of Groeningen.
24 Doctoral Thesis Defence: *Control of Capacity-Constrained Networks in a District Heating Setting*, Felix Agner, LTH. Opponent: Professor Jakob Stoustrup, Aalborg University.
29 AI Lund lunch seminar: *GPT in examination - experiment and lessons,* Felix Agner and Julia Adlercreutz, PhD students, Automatic Control, LTH.

Febuary

03 Seminar: *Robust Machine Learning, Reinforcement Learning and Autonomy: A Unifying Theory via Performance and Risk Tradeoff,* John S. Baras, Institute for Systems Research and Department of Electrical and Computer Engineering, University of Maryland College Park, USA.
12 Master's Thesis Presentation: *Machine Learning for Mortality Risk Prediction: A Study on Cohort Data*, Jim Jakobsson LTH.
14 Licentiate Thesis Defense: *Adaptive Control of Positive Systems*, Fethi Bencherki, LTH. Opponent: Postdoctoral Fellow Yassir Jedra, Massachusetts Institute of Technology.
14 Seminar: *Finite Sample Identification of Partially Observed Bilinear Dynamical Systems*, Yassir Jedra, MIT.
28 Licentiate Thesis Defense: *Minimax Regulator Problems for Positive Systems with their Application to Synchronization of Multi-Agent Systems*, Alba Gurpegui Ramón LTH. Opponent: Professor Claudio Altafini, Linköping University.
28 Seminar: *Quantifying leadership in complex negotiation processes: a social power game*, Claudio Altafini, Linköping University.

March

20 Seminar: *Gain- and phase-type multipliers for phase- and gain-type robustness*, Axel Ringh, Chalmers University of Technology and University of Gothenburg.
20 Seminar: *The Nonlinear Small-Gain Theory for Networks and Control*, Zhong-Ping Jiang, New York University.
20 Seminar: *Adaptive Learning and Control with Binary-Valued Output Observations*, Lantian Zhang, KTH Royal Institute of Technology.
21 Doctoral Thesis Defence: *On Performance Guarantees for Systems with Conic Constraints*, Emil Vladu, LTH. Opponent: Professor Bassam Bamieh, University of California, Santa Barbara.
27 Seminar: *Learning-enabled control methods for personalized health: the case of Type 1 Diabetes*, Marzia Cescon, University of Houston.
28 Doctoral Thesis Defence: *Modeling and Control of Pharmacological Systems*, Ylva Wahlquist, LTH. Opponent: Marzia Cescon, University of Houston.

April

02 Seminar: *Microalgae Production Systems: A Sustainable Solution for Societal Challenges and A Playground for Control Engineers*, José Luis Guzmán, University of Almería.
07 Seminar: *Policy Evaluation in Distributional LQR*, Yulong Gao, Imperial College London.

May

15 Seminar: *Modiator - Web App for Modelica simulation and Github Copilot for Modelica modeling*, Hilding Elmqvist, Mogram AB.
15 Master's Thesis Presentation: *Using Similarity to Accelerate the Primal-Dual Hybrid Gradient Algorithm for Linear Programming*, Theodor Anderberg Törngren, LTH.
21 Seminar: *Leadership in start-ups and growth companies*, Semmy Rülf.
26 Master's Thesis Presentation: *A Machine Learning Approach to Enhancing Supplier Quality Risk Assessment*, William Hansson och Tobias Gustafsson, LTH.
27 *How Networks Work*, Fika-to fika workshop by Lund University Profile Area Natural and Artificial Cognition.
28 Master's Thesis Presentation: *Control strategies for high inertia servo systems*, Erik Kugelberg and Victor Lennartsson, LTH.

June

02 Master's Thesis Presentation: *Speech Embeddings in an Auditory Attention Decoding Framework,* Simon Löwgren and Ruqayyah Nabage, LTH.
02 Master's Thesis Presentation: *The Effect of SNR on Auditory Attention Decoding*, Cajsa Thulin and Josefine Müller, LTH.
03 Master's Thesis Presentation: *Modeling and Simulation with Interval Uncertainties in Julia - Framework Development and Robotic Applications*, Rasmus Kovacs, LTH.
03 Master's Thesis Presentation: *On The Fully Dynamic All-Pairs Shortest Path Problem In Sparse Digraphs*, Lennart Küssner, LTH.
03 Master's Thesis Presentation: *Scalable Optimization of Product Category Embeddings Using Multi-Dimensional Scaling and LLM Embeddings*, Nils Cederberg and Adam Stenström, LTH.
03 Master's Thesis Presentation: *Streamlining Data-Centric ML-Ops in the Integrated Control System at ESS*, Christoffer Gyllenstierna and Victor Ritseson, LTH.
03 Seminar: *Two dynamic load balancing problems in contemporary transportation and cloud networks*, Fernando Paganini, Universidad ORT Uruguay.
04 Master's Thesis Presentation: *Model-based Control for Optical Image Stabilization*, Albin Lindmark and Sofia Philipson, LTH.
04 Master's Thesis Presentation: *Deviation Detection in Dual Motor-Driven Industrial Doors*, Nanna Öström and William Hällsson, LTH.
04 Seminar: *Input-Driven Memory Retrieval in Hopfield Networks*, Giacomo Baggio, University of Padova.
04 Seminar: *Consensus on the unit sphere and some related problems*, Johan Thunberg, LTH.
04 Seminar: *An overview of recent advances in exact complexity certification for MPC*, Daniel Axehill, Linköping University.
05 Doctoral Thesis Defence: *Scalable Control Design for Networked Systems: Coordination through Local Cooperation*, Jonas Hansson, LTH. Opponent: Professor Fernando Paganini, Universidad ORT, Uruguay.

05 Master's Thesis Presentation: *Robot force/motion tracking and estimation of contact geometric parameters,* Filip Karlsson, LTH.
05 Master's Thesis Presentation: *Applying and proving suitable planning principles on RRT* for autonomous trucks*, Fabian Feltenmark, LTH.
09 Master's Thesis Presentation: *Alarm Philosophy and Novelty Detection for the ESS Fast Beam Interlock System*, Joel Utsi, LTH.
09 Master's Thesis Presentation: *Enhancing a Log-analyzer with Graph-RAG*, Tobias Johansson and Ishaaq Khan, LTH.
09 Master's Thesis Presentation: *Residential Load Disaggregation Using Deep Learning Methods*, Viktor Fredriksson, LTH.
10 Master's Thesis Presentation: *Variable Resonance Frequency Identification in a Magnetic Track System*, Christian Melgar and Felix Hemark, LTH.
10 Master's Thesis Presentation: *Learning and Model Predictive Control applied to Energy Optimization of Chiller Plants for Data Centers*, Oskar Hübsch and Simon Horovitz, LTH.
10 Master's Thesis Presentation: *Mobile Robot Manipulator Control for Interacting with 1-DoF Mechanisms*, Yuyao Liu, LTH.
10 Bachelor's Thesis Presentation: *Novel Applications of Machine Learning to Guide Diagnosis of Endocarditis*, Axel Svenningsson, LTH.
16 Master's Thesis Presentation: *Tell the Flows: GNN-Based Graph Optimization under Natural Language Soft Constraints*, Karl Rydén, LTH.
16 Master's Thesis Presentation: *Machine Learning for improving Throttle airflow estimation*, Martin Lindell, LTH.
23 Seminar: *Any-dimensional polynomial optimization*, Venkat Chandrasekaran, Caltech.

August

15 Master's Thesis Presentation: *Acoustophoresis-driven Multiparticle Control in a Microfluidic Device*, Guilherme J. Perticarari, LTH.
18 Master's Thesis Presentation: *Comparing Gradient-Based and Sampling-Based Model Predictive Control for Autonomous Racing*, Leonid Meledin, LTH.
18 Master's Thesis Presentation: *Vision-Based Feedback Control for High-Precision Beam Alignment using a Robotic Arm at ESS*, Timothy Stjernfeldt and Clara Ulmestrand, LTH.

September

17 Seminar: *Eco-driving Incentive Mechanisms for Mitigating Urban Emissions*, Umar Niazi, KTH Royal Institute of Technology.
18 AI and Digitalization Breakfast Seminar: *Explainable AI (XAI): Concepts, Tools and Applications.*
22 Seminar: *Discrete State System Identification, and other Model Approximation Problems,* Carolyn Beck.
25 Master's Thesis Presentation: *Visual Tracking for On-Orbit Robotic Manipulation*, Harald Haglund, LTH.
26 Doctoral Thesis Defence: *Lyapunov analyses for first-order methods: Theory, automation, and algorithm design*, Manu Upadhyaya, LTH. Opponent: Assistant Professor Bartolomeo Stellato (Princeton University).
30 Seminar: Zenseact presentation, Lin Trang.

October

02 Seminar: *Leveraging data-driven approaches in power electronics*, Pauline Kergus.
07 Fika-to-fika Workshop: about research about on *how aspects of human, animal, or artificial cognition, through communication and other forms of interaction, influence behaviour in the individual, dyadic, or collective context*.
15 AI and Digitalization Breakfast Seminar: *Computer Vision and Machine Learning, on Certifiably Optimal Anisotropic Rotation Averaging*, Professor Carl Olsson, LTH.
17 Master's Thesis Presentation: : *Balancing the operating conditions of dual alternators using a 3-DOF PID controller*, Anes Mehmedagic and Viktor Nyman, LTH.
17 Master's Thesis Presentation: *Machine Learning for Air Charge Estimation: A residual Error Approach*, Lukas Christensson, LTH.
17 Seminar: *Close the Loop: From Data to Actions in Complex Systems*, Na Li, Harvard University.
29 Seminar: *Learning for Safety and Control Design in Dynamical Systems*, Geir E. Dullerud, University of Minnesota.

November

04 Seminar: *Perception and Planning for Dual-arm Robotic Manipulation of Multi-Deformable Linear Objects in Wire Harness Assembly*, Pablo Malvido Fresnillo, Tampere University.
04 Seminar: *Data-driven manipulation and control of deformable objects*, Ignacio Cuiral Zueco, University of Zaragoza.
06 Seminar: *Hierarchical Bio-Inspired Learning for Legged Locomotion*, Guillaume Bellegarda, École Polytechnique Fédérale de Lausanne.
06 Seminar: *Scaling Robot Skill Acquisition through Prior Knowledge*, Quantao Yang, KTH Royal Institute of Technology.
11 Seminar: *From Ego to Eco-System: Perception & Fusion for Autonomous and Connected Mobility*, Simone Mentasti, Politecnico di Milano.
11 Seminar: *Scalable and Human-Aware Multi-Robot Coordination in Dynamic Environments*, Maryam Kazemi.
12 AI and Digitalization Breakfast Seminar: *Modeling and Analysis of Epidemic Dynamics over Networks*, Lise Meitner Professor Carolyn Beck.
13 Seminar: *Dynamic manipulation of deformable objects, past work and challenges*, Adriá Colomé, the Institut de Robòtica i Informàtica Industrial.
13 Seminar: *Online robot learning in hardware: Challenges and opportunities*, Thomas Berrueta, Caltech.
21 Doctoral Thesis Defence: *Real-Time Brain-Computer Interfaces*, Pex Tufvesson, Ericsson. Opponent: Associate Professor Laurent Bougrain, University of Lorraine.
24 Seminar: *Feedback Models for Robotic Cloth Manipulation*, Oriol Barbany.
25 Start of Robotics week for school classes.
26 Robotics Cognition and Automation - a robotics week seminar and lab tour.
27 Robotics Cognition and Automation - a robotics week seminar and lab tour.
28 Master's Thesis Presentation: *6D Pose Estimation and Calibration for Autonomous On-Orbit Servicing using the OOS-Sim*, Daniel Eklund, LTH.

December

01 Seminar: *In-Hand Slip-Aware Object Manipulation*, Gabriel Arslan Waltersson, Chalmers University of Technology.

01 Seminar: *Scalable and Generalizable Robot Learning: from Simulated to Real-World Applications,* Gabriele Tiboni, JMU Würzburg and Pearl Lab at TU Darmstadt.

02 Seminar: *Implicit Bias in Matrix Factorization and a New Neural Network*, Alp Yurtsever.

02 Seminar: *Achieving Coordination with Multiple Heterogeneous Agents*, Martina Lippi, Roma Tre University.

02 Seminar: *Adaptive Sensor Fusion for Autonomous Driving in Harsh Weather Conditions*, Thu Ngo, Halmstad University.

03 Seminar: *Learning by Demonstration with Dynamic Movement Primitives: Adaptation, Safety and Applications*, Leonidas Koutras, Aristotle University of Thessaloniki.

03 Seminar: *Learning Failure Prevention Skills for Safe Robot Manipulation*, Abdullah Cihan Ak, Istanbul Technical University.

04 Seminar: *Safe and Efficient Structured Learning for Robotics*, Raffaello Camoriano, Politecnico di Torino & Istituto Italiano di Tecnologia.

04 Seminar: *Machine learning for scaled autonomous racing and beyond*, Piotr Kicki, IDEAS Research Institute & the Institute of Robotics and Machine Intelligence at Poznan University of Technology.

10 AI and Digitalization Breakfast Seminar: *Neuromorphic technology – Rethinking the computer for AI*, Mattias Borg and Baktash Behmanesh, LTH.

15 Master's Thesis Presentation: *Physical Human-Robot Interaction Using a Mobile Manipulator*, Johan Furuhjelm and Oliver Larsson, LTH.

16 Master's Thesis Presentation: *Coordinated Load Attacks on Modern Distribution Grids: Modeling and Simulation on a European Medium Voltage Grid with Droop Controlled DERs*, Alexandra Annedotter and Oscar Unosson, LTH.

19 Master's Thesis Presentation: *ROS-Based Rendezvous Landing and PDDL-Based AI Planning of Robotic Inspection Missions, Deploying UAV Quadcopters and UGV Ground Robots*, Hicham Mohamad, LTH.

External Engagement

External Engagement of importance

We have had collaborations with a large number of different organizations in academia and industry, both domestically and internationally. We are very happy for all collaborations and proud to have a large and stable network. This enables us to expand our research horizon and to be an important partner in future projects.

During the year we have arranged conferences in Lund with both national and international participation. This year the Swedish Control Conference took place in Lund and also the ELLIIT Focus period on Robot Learning during fall, which coincided with the Robotics week, well visited from schools, companies and the general public.

SWEDISH CONTROL CONFERENCE

In June, the department hosted the bi annual Swedish Control Conference (Reglermötet). It consisted of a PhD student day on June 11, a meeting for technical and administrative staff on June 11-12 and the traditional teachers day. Teachers day program included updates from the Swedish control departments, discussions about undergraduate and doctoral education, discussions about the use of AI and large language models in teaching and examination, and guided tours of the RobotLab and the X-Lab makerspace. The main scientific conference took place on June 12-13.

The conference attracted 199 participants, including 83 PhD students. The scientific programme included 12 sessions with a total of 59 oral paper presentations, as well as two poster sessions featuring 59 posters. Keynote lectures were delivered by Melanie Zeilinger (ETH Zürich), Per Skarin and Mårten Lager (Saab), and Erik Möllerstedt (Aurora). The conference banquet was held at the Grand Hotel in Lund.

Equipped for a tour in the LaserLab

Colleagues from other Universities

The programme for technical and administrative staff ran in parallel included presentations, study visits, and networking activities. Before the programme started the participants could enjoy newly produced musical videos produced by staff of the hosting Department. The opening of the conference started with keynote lecturer Erik Möllerstedt, Aurora. The programme also included visits to XLab and LaserLab, as well as a guided walk through Lund. Common lunches and a dinner at *Långa Bryggan* in Bjärred together with the teachers' group were included. The conference dinner on Thursday evening at the Grand Hotel concluded this part of the event

The PhD Student Day gathered doctoral students from participating universities for a full day of joint activities. The programme began with a visit to X Lab, followed by a guided study visit to the European Spallation Source (ESS), where participants were introduced to the facility's control systems and infrastructure. The afternoon included a dragon boat competition in the Malmö Canal, with teams representing the different universities; the Lund team won the competition. The day concluded with a joint dinner at Balkan Etno.

Dragon boat race

Mingling outside before entering Grand Hotel for the Conference Banquet

ELLIIT FOCUS PERIOD: ROBOT LEARNING, NOVEMBER 3 - DECEMBER 5

Robot learning focuses on developing algorithms and methods that enable robots to learn from interactions with their environment, simulated experiences, as well as humans. In robot learning, traditional machinelearning approaches such as supervised learning and reinforcement learning take on new dimensions, while aspects such as data efficiency, reliability, generalization, transfer learning, and safety gain increased importance.

Robot learning is driven by the need for robots to function effectively in diverse environments, allowing them to adapt to new tasks and interact with various objects and dynamic agents without continuous reprogramming. The growing interest in robot learning stems from its broad potential. In industry, robot learning can enable flexible automation systems capable of handling variable tasks like assembly, packaging, and inspection. Socially, advances in robot learning could facilitate the deployment of general-purpose robots in human-centered environments, such as homes, healthcare facilities, and educational institutions, while enabling specialized robots, like surgical robots, to operate with even greater precision. However, these advancements bring important considerations. The deployment of robots and autonomous systems that can learn and adapt raises questions around worker displacement, privacy, and ethical machine behaviour, which must be part of a larger conversation. As robots become increasingly integrated into our daily lives, understanding and advancing robot learning is not just an academic pursuit but a necessity for a sustainable and beneficial integration.

Robot learning is an interdisciplinary field, drawing on insights from machine learning, robotics, control theory, and neuroscience to develop adaptive and intelligent systems. Collaboration across these fields is vital for advancing robot learning. As we progress toward a future with more autonomous systems, the ELLIIT focus period initiative aimed to review state-of-the-art techniques, address current and future challenges, and forecast the societal and industrial impacts of robot learning.

During the third week, a three-day symposium was held with several invited top-level researchers. The symposium is the central point of a five week focus period devoted to a specific subject. During the focus period, ELLIIT invites visiting scholars to stay in the environment for 3-5 weeks.

Highlights

The ELLIIT focus period symposium on robot learning gathered roboticists from all over the world in Lund for three days of talks, panel discussions, and networking. At the end of each symposium day, all the speakers of the day formed a panel that was moderated by a member of the scientific committee for that day.

The panel discussion started off with key takeaways from each panellist's talk.

– There were a lot of questions throughout the whole day, and not always time in the schedule, but these could then be handled in the panel discussion, which created important interaction, says Yiannis Karayiannidis, member of the organising committee.

The focus of the symposium has been not only on achievements but also on remaining open questions:

– The panel discussions have been a good way to pick up on the open questions, the challenges we still need to address through research. Having speakers with different research directions creates a good environment for discussing and shedding light on questions from different perspectives, says Björn Olofsson, member of the organising committee.

Being able to invite top researchers and leaders in their fields is one of the strengths of the focus period concept. Robot learning is a multidisciplinary field, and the broad range of perspectives was reflected in the speakers' topics over the three fully packed symposium days.

As one attendee, Lund PhD student in automatic control Marko Guberina, put it:

– I seldom get to meet roboticists, now I'm surrounded by them!

Marko Guberina also appreciated the panel discussion at the end of the days, describing how the discussions can significantly shift perspectives on specific topics.

The ELLIIT focus period includes visiting scholars staying at the hosting faculty for three weeks, in two rounds, so for some of the visiting scholars the symposium marked the end of their stay.

For Maryam Kasemieskeri and Thomas Berrueta, the focus period has been a positive experience.

– The flexibility of the organization has been great, and the possibilities to meet and interact with PhD students and senior researchers here in Lund, says Thomas Berrueta.

As examples of outcomes of the focus period, Thomas Berrueta lists the networking opportunities and gaining knowledge of where others in the field are focusing their research. Maryam Kasemieskeri's research questions are not specifically in the scope of robot learning, yet the topics, community, and the peer support of the group of visiting scholars have been rewarding.

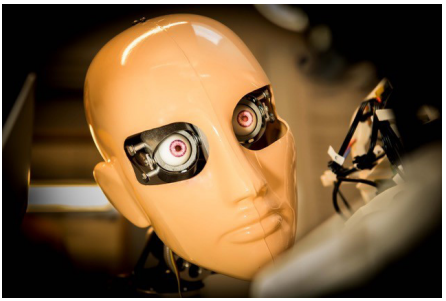
– Giving a talk in the seminar series, and presenting and working with the visiting scholars group has been good practice, says Maryam Kasemieskeri.

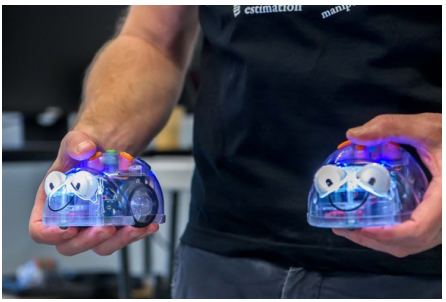
The foremost takeaways for both are the sense of community that quickly formed during the weeks of the visit, and the ease of interaction with visiting scholars, lab environments, and Lund faculty members. The organising committee of the ELLIIT focus period on robot learning was: Yiannis Karayiannidis (LU), Björn Olofsson (LU), Volker Krueger (LU), Erik Frisk (LiU), Eva Westin (LU) and Susanne Lönnqvist (LU).

Group of roboticists

The organising committee

AI LUND





AI Lund is an open network for research, education and innovation in the domain of artificial intelligence at Lund University.

During 2025 the organisation got more funding and partly an upgraded organisation. Many researchers at the Department of Automatic Control actively contribute to the network via lunch seminars and presentations at workshops and conferences and the annual Robotics Week reaching about 400 school children. The department's excellent TA staff also participates in organising AI Lund as such in administering parts of AI Lund's finances.

In 2025, the annual EU Robotics Week, coincided with the ELLIIT Focus period on Robot Learning.

Pictures: Kennet Rouna 2025

Economy

This chapter contains an overall view of the economy and funding

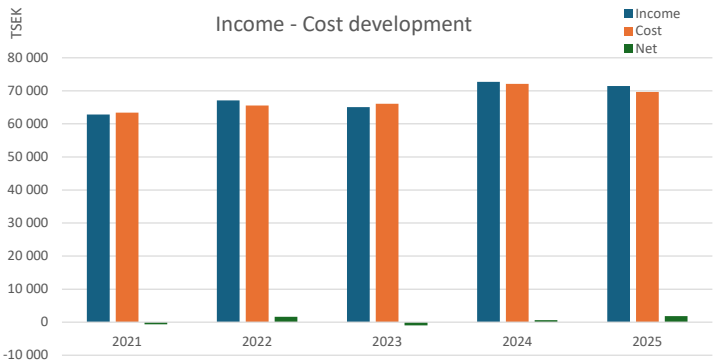
ECONOMY

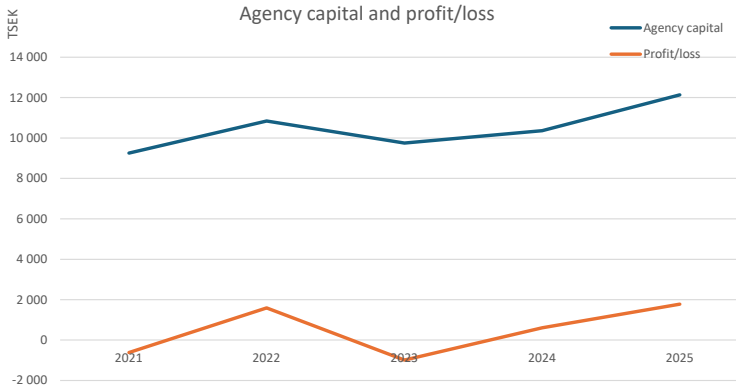
The turnover for 2025 was 71.4 MSEK. Somewhat less than half of the income comes from Lund University and the remaining part from external grants. We made a positive result of 1.8 MSEK and we have now an Agency Capital amounting to 12.1 MSEK.

Today the number of employees are 51 which corresponds to 45 full-time equivalents (teaching assistants not inluded). Substantial support of our different activities have been provided by the European Union Horizon 2020 programme, Knut and Alice Wallenberg Foundation (KAW) and ELLIIT where and we have been receiving funding for PhD and Postdoc positions.

In 2025 we have been successful in receiving new funding from another ERC Advanced Grant, Swedish Research Council (VR), ELLIIT and KAW within the WASP programme.

The block grants from KAW and ELLIIT are long range. Some projects do, however, have shorter duration such as three years or less. To match these with the length of a PhD position, normally five years, we have a long-term internal research planning, and we are careful to bid on projects that fit into our research plan. This has proven efficient to match short-term funding, research planning and personnel.





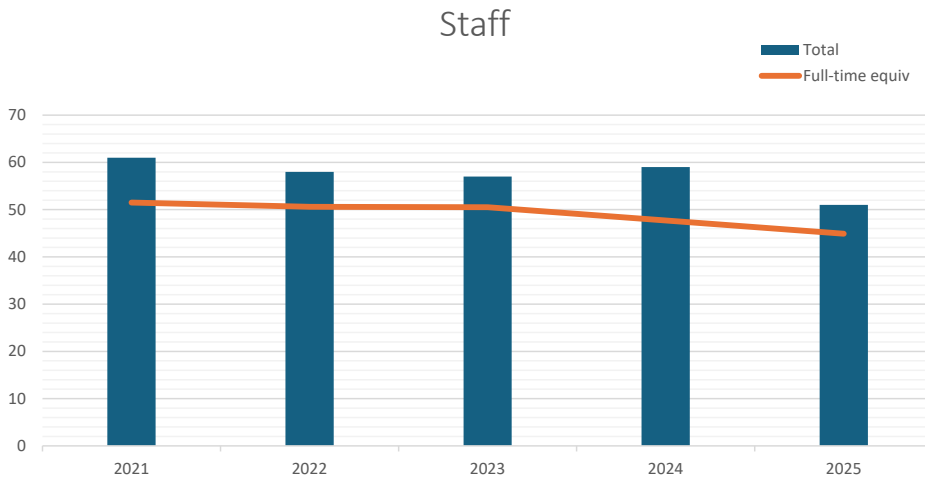
FUNDING

During 2025 we had the following external grants:

VR – A Framework for MPC Stability Analysis
VR – Statistical Learning Theory for Safety-Critical Control: Fundamental Limits and Optimal Algorithms
VR – Research collaboration Italy-Sweden
VR – Dynamic Fragilities in Societal-Scale Networks
Vinnova – Advanced Offloading for Real-Time Applications (AORTA)
EU Horizon 2020 – Scalable Control of Interconnected Systems - an ERC project
ERC Advanced Grant – DualControl - starting in January 2026
KAW – Wallenberg AI, Autonomous Systems and Software Program (WASP)
KAW – WASP DDLS Twinning project: Learning pharmacometric model structures from data
KAW – WASP NEST Learning in Networks, Structure, Dynamics & Control
KAW – WASP NEST Cyber Security
KAW – WASP WARA-PS
KAW – WASP WARA-Robotics
ELLIIT – Robust and Secure Control over the Cloud
ELLIIT – Autonomous Force-Aware Swift Motion Control
ELLIIT – Scalable Optimization for Learning in Control
ELLIIT – Visual Feature Based Data Reduction
ELLIIT – Dynamics of complex socio-technological network systems
ELLIIT – Recruitment of an Associate Professor in Robotics
ELLIIT – Infrastructure Robotics
ELLIIT – Optimal estimation and control at scale
ELLIIT – Visual analytics of large and complex multilayer technological networks
ELLIIT – Integrated reactive motion planning and motion control
ELLIIT – Gender and Diversity Group
Mats Paulsson Foundation - Functional ex vivo heart evaluation
The Hjelm Family Foundation - Functional ex vivo heart evaluation
IFAC Activity Fund
IEEE – Outreach Fund
Crafoord Foundation. Project: 2DCAM
Crafoord Foundations. Project: UAVIPOD
SAR-Sweden (Scholars At Risk Sweden), Co-funding 2DCAM

Staff

In this chapter the personnel and their activities are described


Staff
Total
Full-time equiv
70
60
50
40
30
20
10
0
2021
2022
2023
2024
2025

Professor Emeriti
Åström, Karl Johan
Hagander, Per
Hägglund, Tore
Johansson, Rolf
Wittenmark, Björn

Professors
Årzén, Karl-Erik, head of department
Beck, Carolyn, Lise Meitner Professor
Bernhardsson, Bo
Eker, Johan (50%)
Fontes, Magnus (20%), adjunct professor
Johnsson, Charlotta
Maggio, Martina (20%)
Rantzer, Anders

Associate Professors
Cervin, Anton (on leave 2025).
Como, Giacomo (5%)
Giselsson, Pontus, director of graduate studies
Karayiannidis, Yiannis
Olofsson, Björn (90%), director of undergraduate studies
Pates, Richard
Soltesz, Kristian
Tegling, Emma; deputy head of department

Research Engineers
Blomdell, Anders
Nilsson, Anders
Pisarevskiy, Alexander
Stenberg, Oskar

Administrators
Edelborg, Cecilia
Nishimura, Mika
Rasmusson, Monika (70%)
Westin, Eva
Wisbrant, Jonas

Postdocs
Jeeninga, Mark
Ziemann, Ingvar (until June)
Sundell, Jesper (until September)

Researchers
Voitenko, Volodymyr
Wu, Dongjun (from April)

PhD Students
Adlercreutz, Julia
Agner, Felix (until January)
Åkerman, Anton
Al-Bayati, Ahmed
Bakovic, Luka
Bencherki, Fethi
Dell'Oro, Marco (from September)
Fregnan, Sebastiano
Gemborn Nilsson, Martin
Grönqvist, Johan (until April)
Guberina, Marko
Gurpegui Ramón, Alba
Hällström, Ask
Hansson, Jonas (until August)
Heskebeck, Frida
Jia, Zheng
Kjellson, Christoffer (from October)
Kovács, Rasmus (from August)
Lindberg, Johan
Nauta, Talitha
Nilsson, Max
Nyberg Carlsson, Max
Ohlin, David
Rydén, Karl (from August)
Sinnema, Yde
Sundström, Emil
Upadhyaya, Manu (until September)
Vladu, Emil (until June)
Wahlquist, Ylva (until April)

Industrial PhD Students
Norlund, Frida; Boliden AB
Mathai, George; Ericsson AB
Steen, Erik; Igelösa (from May)
Stoltenberg, Peter; Saab Kockums AB
Tufvesson, Pex; Ericsson AB (until November)
Wingqvist, Birgitta; Saab Kockums AB
Ydreskog, Markus; Sertech (from March)

JÄLM@REGLER - THE GENDER EQUALITY, EQUAL OPPORTUNITIES, AND DIVERSITY GROUP AT THE DEPARTMENT


Richard


Frida


Johan


Yiannis


Cecilia


Emil

Jälm@regler is the dedicated gender equality, equal opportunities, and diversity group at our department. Since its start in 2014, the group has been actively working to create an inclusive and supportive environment. The group has organized seminars and workshops featuring invited speakers who address a wide range of topics, including research, ergonomics, security, and implementation. These events create valuable opportunities for discussion and learning, helping to raise awareness and drive positive change.

Key Activities in 2025

In 2025, the group, consisting of Richard Pates, Frida Norlund, Johan Lindberg, Yiannis Karayiannidis, Cecilia Edelborg and Emil Sundström, has been involved in several activities:

- Seminars and Workshops: Continuing the tradition of inviting experts to speak on various topics, these events have provided insights and fostered discussions on gender equality and diversity.
- Coffee Break Discussions: Creating informal spaces for conversations about gender equality and diversity has proven crucial for fostering awareness and encouraging positive change within the department.

Inspiring Project: Historical Female Influencers in Automatic Control

One of the standout initiatives is the project entitled *Historical Female Influencers in Automatic Control*. This project highlights the contributions of female pioneers and role models in the field of control technology. By celebrating their achievements, the project aims to inspire current students and shape the narrative for future generations. The stories of these women serve as powerful reminders of the significant impact women have had and continue to have in technology and academia. The project has been presented in December at CDC Rio de Janiero, but also at a seminar where the new Lise Meitner Professors were introduced.

Eva Westin

Charlotta Johnsson

Margret Bauer

Dedicated to the power of role models in academia, LTH's Lise Meitner seminar on October 15 was jam-packed. With a main lecture by Charlotta Johnsson, Eva Westin and Margret Bauer at Automatic Control, followed by a panel discussion, the event was concluded by the Dean of LTH presenting the new Lise Meitner professors with diplomas. Carolyn Beck, to the very left on the below picture, will be at the Department of Automatic Control for three years.

Lise Meitner Professors

LONG-TERM VISITORS

Abdezaher, Tarek, University of Illinois, USA (December)
Caparroz, Malena, PhD student, University of Almería, Spain (September)
Hoyo Sanchez, Angeles, University of Malaga, Spain (September)
Nebeluk, Robert, PhD student, Warsaw University of Technology, Poland
Schurig, Roland, PhD student, Technical University of Darmstadt, Germany (from August)
Seidel, Marc, PhD student, University of Stuttgart, Germany (January-March)

BOARD OF THE DEPARTMENT

Anders Rantzer
Karl-Erik Årzén
Charlotta Johnsson
Martina Maggio
Kristian Soltesz
Björn Olofsson
Yiannis Karayiannidis
Richard Pates
Mark Jeeninga
Monika Rasmusson
Anders Nilsson
Talitha Nauta
Ask Hällström

STAFF ACTIVITIES

Agner, Felix

PhD student and since March 2023 he has the degree Licentiate as he successfully defended his thesis *On Hydraulic Constraints in Control of District Heating Systems*.

His research interests are scalable control for energy systems, focusing on the application of district heating systems. In January 2025 he defended his thesis with the title *Control of Capacity Constrained Networks - in a District Heating Setting*.

Adlercreutz, Julia

MSc in Engineering Physics 2022 at LTH. PhD student since August 2022.

Her main research area is structured optimal control for large scale systems. She is supervised by Richard Pates and is funded by ELLIIT.

During the year she has been a teaching assistant in the *basic and the advanced course in Automatic Control* as well as the course *Control Theory*.

Åkerman, Anton

MSc in Engineering Mathematics, LTH, 2023. PhD student at the department since August 2023.

Current research is on first-order splitting methods for solving convex optimization and monotone inclusion problems.

Anton has been a teaching assistant in the the course *Optimization for learning* and the *Automatic Control Basic Course*.

Al-Bayati, Ahmed

MSc in Engineering Physics from LTH, and has been a PhD student since August 2023.

His research is focused on offloading control algorithms to the cloud and/or edge under the supervision of Professor Karl-Erik Årzén. He is funded by the AORTA, a Vinnova project.

In 2025, Ahmed worked on developing a motion planning algorithm designed for edge deployment. This planner efficiently avoided obstacles while generating trajectories that respects jerk constraints.

In addition to his research, Ahmed taught *Real-Time Systems* in the spring and was involoved in teaching and developing parts of the new *Cloud* course.

Årzén, Karl-Erik

Professor (2000), PhD (1987), joined the department in 1981.

His research interests are real-time and embedded control, real-time systems, cloud control, feedback computing, autonomous systems, and programming languages for control.

Coordinator for the Lund part of WASP (Wallenberg AI, Autonomous Systems and Software Program). He also contributes to the LTH profile area *AI and Digitalization*, as well as the LU profile area *Natural and Artificial Cognition*.

During the year he has primarily been involved with WASP, ELLIIT, and the Vinnova AORTA project.

He is partly or fully involved in the supervision of three PhD students.

Bakovic, Luka

MSc in Automatic Control, received in 2021 from the University of Zagreb. PhD student at the department since 2022.

His research interest is in the area of opinion dynamics and socio-technical systems, supervised by Emma Tegling and Giacomo Como.

He has been teaching *Learning-Based Control* and *Network Dynamics*.

Bencherki, Fethi

MSc in control systems in 2020 from Eskisehir Technical University, Turkey. PhD student at the department since Aug 2020. He is supervised by Anders Rantzer and Emma Tegling.

Fethi's research is carried out within the NEST–WASP project and focuses on scalable control methods for large-scale networked systems. His interests also include learning-based control, positive systems, and data-driven identification of hybrid and switched linear dynamics, with the goal of developing methods that scale to high-dimensional interconnected systems while retaining theoretical guarantees.

From March to June 2025, he conducted a research visit at the Electrical and Systems Engineering Department, University of Pennsylvania, collaborating on topics at the intersection of learning and control for networked systems.

In 2025, his teaching assignments included the *Automatic Control* basic course and *Nonlinear Control and Servo Systems*.

Bernhardsson, Bo

PhD 1992, Professor since 1999. He has also worked at Ericsson 2001 to 2010 as an Expert in *Mobile System Design and Optimization*. Since 2020, he has served as one of the Master Programme Directors for the international master's programme in *Machine Learning, Systems and Control*.

He also contributes to the LTH profile areas *Engineering Health and AI and Digitalization*, as well as the LU profile area *Natural and Artificial Cognition*.

His current research focuses on control and statistical learning, with applications to areas such as EEG signal analysis, communication systems, and life science data. He is the main supervisor of three PhD students in this area and co-supervisor of two additional PhD students. He is also responsible for coordinating the Master Thesis projects.

During 2025, he taught the *basic control* course.

Blomdell, Anders

Research Engineer at the department since1988.

Responsible for the department network and lab computers for teaching and research.

Como, Giacomo

PhD (2008), Docent (2012). He has been at the Department of Automatic Control since 2011 and was promoted Associate Professor in 2013.

His research interests are in Dynamics, Information, and Control in Networks, with applications to transport, infrastructure, as well as social and economic systems.

During 2025, he has mainly been on leave at Politecnico di Torino.

Dell'Oro, Marco

MSc in Mechanical Engineering (Mechatronics and Robotics) from Politecnico di Milano in 2024.PhD student since August 2025 and supervised by Pontus Giselsson. Before joining the Automatic Control Department, he worked

as a research assistant at TU Eindhoven, Control System Technology Department.

Marco's research focuses on general fixed-point problems and associated fixed-point iteration algorithms.

He has been a Teaching Assistant of the *Basic Control* course during fall.

Edelborg, Cecilia
Cecilia has been the Financial and HR Administrator at the department since 2017.

She is responsible for accounting, travel expenses, reimbursements, intermittent employments, invoices, and project-related administration. Her role also includes HR administration, coordination of guests and conferences, as well as responsibilities as departmental registrar and purchasing coordinator.

She holds an academic background from the Faculty of Law at Lund University.

Eker, Johan
Johan is Professor (50%) and also holds a position as Principal Researcher at Ericsson Research (50%). He received his PhD in Automatic Control, Lund University in 1999 and became full Professor in 2023.

His research interests includes methods and programming languages for parallel systems, real-time control systems, data-driven operation and cloud computing technologies. His current research focus is on compute offloading and data-driven operations of large scale systems.

He is the co-designer of the CAL Actor Language, which is part of the MPEG standard ISO/IEC 23001-4:2011. He holds over 80 granted patents in the areas of telecom, IoT and cloud computing. He is involved in the operation of the Ericsson Research Data Center and works with industrial cloud applications and data-driven systems.

He is participating in a range of program committees and research projects on topics such as real-systems, signal processing, software development, cloud technology, brain-computer interfaces, and AI.

Johan is the main supervisor for Emil Sundström and co-supervisor for Frida Norlund, Max Nyberg Carlsson, Ahmed Albayati, and Ngoc Hung Nguyen.

Fregnan, Sebastiano
MSc in Computer Engineering for Robotics, 2022. He has been a Research Fellow at University of Verona before joining the department as PhD student at the beginning of 2024.

His research focuses on whole-body compliant manipulation and aims to render robotic motion feel more natural while dealing with spatial obstacles and achieving tasks requiring exploration of and contact with the environment. In particular, he contributed to the hardware and software setup of an in-house built mobile manipulator (an ABB Dual-Arm YuMi mounted on the custom "Sleipner" mobile robot) to test and demo his research. He is also affiliated with WARA Robotics headquartered at ABB Robotics.

His teaching activities consisted of lab supervision of the *Automatic Control, Basic Course* and the *Applied Robotics* course, and project supervision of two groups for the *Mathematical Modelling* course and two groups for the *Project in Systems, Control and Learning*.

Gemborn Nilsson, Martin
MSc in Electrical Engineering 2020, Lund University. PhD student at the department since January 2021.

Supervised by Bo Bernhardsson and funded by ELLIIT, his research focuses on the representation and classification of multivariate time-series using covariance structures, with the improved efficiency of EEG-based Brain-Computer Interfaces serving as the main example application.

Giselsson, Pontus
Pontus has been serving as an Associate Professor at the Department of Automatic Control since 2017. He completed his PhD in Automatic Control 2012. Pontus was awarded the title of Reader (Docent) in 2018.

His research primarily focuses on optimization and its wide range of applications.

In 2025, he taught the undergraduate courses in *Optimization for Learning*, *Systems Engineering*, and *Process Control*. Pontus supervised numerous Master's thesis projects and guided five PhD students out of which one graduated during 2025.

Additionally, he is the director of doctoral studies at his department.

Grönqvist, Johan
PhD (Physics), 2010, LTH and PhD student at the department since 2019.

His general control interest are learning, and robustness. He is trying to obtain guaranteed closed loop properties with Neural Networks.

Guberina, Marko
MSc in Physics Engineering 2022 at Chalmers. PhD student at the department since September 2022 and became WASP-affiliated in January 2023. He is supervised by Yiannis Karayiannidis and Björn Olofsson and funded by ELLIIT.

His research interest is in robotic hand-arm coordination for robotic manipulation tasks.

Gurpegui Ramón, Alba
MSc in Mathematics, Lund University. PhD Student at the department of Automatic Control since August 2022 and supervised by Anders Rantzer.

Her main research interests include optimal and robust control of positive systems, and their applications to large-scale systems and network synchronization. She is part of the NEST project Learning in Networks.

In February 2025, she defended her Licenciate Thesis.

Her teaching responsibilities included the *Advanced Control* course and the *Basic Control* course.

She has attended ECC 2025 in Greece and was also awarded The Student Travel Support, which covered the registration fee for ECC 2025.

She also attended NecSys 2025 in Hong Kong, where she visited and gave seminars to the groups of Prof. James Lam at HKU and Prof. Ji Chen at CityUHK.

Hällström, Ask
MSc in Engineering Physics, LTH (2024). PhD student since August 2024. He is supervised by Richard Pates and funded by Compel.

Over the past year, Ask has collaborated with Comsys to analyze unstable behaviors in active filters, with applications involving battery systems and renewable energy sources. He co-authored a paper titled *Properties of Hydraulic Equilibria in District Heating Networks* with Felix Agner and Richard Pates, which he presented at the Conference on Decision and Control (CDC). He also presented joint work with Frida Heskebeck and Pex Tufvedsson on *an online tool for automatic control teaching* at the European Control Conference (ECC).

Ask has continued his research on control and string stability of platoons stemming from his MSc thesis, making progress toward proving a conjecture proposed by Kaoru Yamamoto.

During the autumn, he also worked to develop further collaboration with IEA and their newly appointed BUL, Ferdinand Grimm.

Throughout the year, he has also served as a teaching assistant in the courses *Process Control* and *Nonlinear Control and Servo Systems*.

Hansson, Jonas
Licentiate and a fifth-year PhD candidate at the Department of Automatic Control, Lund University. He is supervised by Emma Tegling and Anders Rantzer, with funding from WASP.

His research focuses on the control of network systems with locality constraints, emphasizing scalable and robust control design with transient performance guarantees. He is also interested in system identification, contraction theory, and fundamental control limitations.

In June he defended his thesis with the title *Scalable Control Design for Networked Systems*.

Heskebeck, Frida
MSc in Biotechnology (2019), Lund University. Since August 2019, she has been a PhD student (two years of parental leave since then) and has a Licentiate degree in automatic control since 2023. Most of 2025, she has been on parental leave. Frida is funded by WASP.

She is working on Brain-Computer Interfaces (BCIs) and has a specific interest in BCI calibration and in individualizing the transfer-learning process for BCIs. She is part of the project Realtime Individualization of Brain Computer Interfaces.

Jeeninga, Mark
MSc in Mathematics (2015), PhD in Automatic Control (2021), both from the University of Groningen. Post-doc at Politecnico di Torino (2021-2023), and at the department since September 2023, hosted by Emma Tegling and Anders Rantzer. He is mainly funded by WASP.

His research interests include the analysis and control of network systems, power flow analysis, matrix and graph theory, district heating networks and vehicle platooning. He has been collaborating on different topics like optimal control of positive systems with disturbances and their application to multi-agent systems, synchronization in higher-order integrator networks and also on multipolar opinion networks with biases and on low rank approximations of linear systems that preserves controllability.

In early 2025, he participated for four weeks in the SPiRiT Programme--an intense eight week programme centered around customer discovery and entepreneurial development.

During spring, Mark has been teaching the *Linear Systems* course for third-cycle students at the department.

In June 2025, he attended ECC2025 where a paper was presented. He also pitched in the Tech Matching for Encubation programme, centered around load flow computation tools for power grid operators. He was matched with three master students at the Chalmers School of Entrepreneurship, with whom he is collaborating towards the creation of a start-up company since September 2025.

He is supervising the master students Louise Nyberg and Samuel Golobov.

Jia, Zheng
MSc in robotics, systems, and control from ETH Zurich in 2017. Zheng started as a PhD student in September 2021 and has been a WASP affiliated PhD student since November 2021.

His research interests include force and motion control of manipulator robots.

This year he presented a paper at IROS 2025 in Hangzhou, China.

He was also a teaching assistant of the courses: *Introduction to Machine Learning, Systems and Control*, *Project in Systems, Control and Learning*, and *Nonlinear Control and Servo Systems*.

Johnsson, Charlotta
Professor (2018), PhD (1999). Charlotta is the Dean of Campus Helsingborg, Lund University. She is also the deputy director for the makerspace X-Lab at LTH, an open innovation space for both students and colleagues.

Charlotta's main research interest covers automation, control and operations. She is also involved in the research domains of innovation and entrepreneurship, teaching and learning in higher education, as well as technology management and engineering leadership.

She is the Chair of ISO TC184/SC5, actively working on development of international standards for Smart Manufacturing and Industry 4.0.

During the year 2025, Charlotta has been course responsible for the course *Projects in Systems control and Learning*.

She has been a guest lecture in several master courses at Lund University. She has also given invited seminars to industry focusing on Industry 4.0/Smart Manufacturing.

Karayiannidis, Yiannis
PhD in Electrical Engineering from Aristotle University of Thessaloniki, Greece, in 2009. Prior to joining Lund University, he was affiliated with KTH Royal Institute of Technology and with Chalmers University of Technology. He received the title of Docent from Chalmers University of Technology in 2017. Yiannis is an Associate Professor at the Department of Automatic Control, since 2022, and has served as co-Director of RobotLab LTH since 2023.

His research interests include robot control and manipulation, robot navigation, haptic perception, physical human–robot interaction, learning-based and adaptive control, and nonlinear control systems. His current research focuses on force-based robot control and perception, contact modeling for manipulation, bimanual and mobile manipulation, and dynamic trajectory generation for robotic systems operating under constraints.

He is a WASP-affiliated faculty member and currently supervises three WASP-funded PhD students.

During 2025, he was responsible for the undergraduate courses *Nonlinear Control and Servo Systems* and *Mathematical Modeling*. He supervised three master's thesis projects and three PhD students working on hand–arm coordination, mobile manipulation, and grasping force control at the Department of Automatic Control.

In addition, he co-supervises two PhD students at the department and serves as the main supervisor of a PhD student affiliated with Chalmers University of Technology.

Kjellson, Christoffer
MSc in Engineering Physics from Lund University in 2021. He joined the department as a PhD student in October 2025.

His main research interests are in control and robustness of network systems.

He was involved as a teaching assistant in *Automatic Control,* basic course.

Kovács, Rasmus
MSc degree in Engineering Physics from Lund University in 2025. He is a PhD student at the department since August 2025.

His research is conducted within the Wallenberg AI, Autonomous Systems and Software Program (WASP) and focuses on robotics, with a particular interest in force control and adaptive control for robotic grippers. He is supervised by Yiannis Karayiannidis and Björn Olofsson.

During 2025 his main research activities mainly consisted of initiating his project through literature studies and early experimental and modeling work.

He has been involved in teaching as a teaching assistant in *Applied Robotics* and *Applied Robotics for Architects*, primarily contributing to exercises, laboratory sessions, and project supervision. He also assisted in *Automatic Control,* basic course, mainly in laboratory sessions.

Lindberg, Johan
MSc in Engineering Physics (2020) and started as a PhD student at the department in September 2020. His supervisor is Richard Pates.

Johan's research interests are towards how decentralized control can be used in the electrical power grid. Especially how to keep it in balance when more power production comes from renewables, that are less predictable than traditional power production, and where the power is injected to the power grid through power electronics, instead of traditional synchronous machines.

Maggio, Martina
PhD, Politecnico di Milano in 2012. She joined Lund University as an assistant (2015), associate (2017) and then full professorship (2023). Martina is Professor at the Computer Science Department, Saarland University since March 2020 and is only part time at the Department of Automatic Control.

Her research focuses on secure autonomy, trustworthy cyber-physical systems, and control in the presence of computational problems.

In 2025, at Lund University, she led two WASP NEST projects: Intelligent Cloud Robotics for Real-Time Manipulation at Scale and Dynamic Attack Detection and Mitigation for Secure Autonomy.

She also led the VR Italy-Sweden collaboration project, Trustworthy Cyber-Physical Pipelines.

Martina supervised PhD student Yde Sinnema at Lund University, as well as Melanie Gallant at Bosch GmbH through Saarland University, and Robert Pietsch and Clara Rubeck at Saarland University.

Nauta, Talitha
MSc in Engineering Mathematics from Lund University in 2023. She has been a PhD student at the deparment since September 2023, now supervised by Richard Pates.

Her main research interests are focused on scaled relative graphs and how to use them for stability and performance guarantees for complex control systems.

During 2025 she has been a teaching assistant in *Real-time Systems* and *Process Control and System Engineering*.

Nilsson, Anders
PhD (2006), Research Engineer since 2010.

He spends most of the time looking after the department computers and their software. He also spends some time maintaining and developing the robotlab.

Nilsson, Max
MSc in Computer Science and Engineering, 2022, Lund University. He is a PhD student since January 2023.

Max research interests are in first order splitting methods and non-Euclidean optimization.

During 2025 he has been a TA for *Optimization for Learning* and responsible for the Friday seminar schedule.

He also co-supervisor the thesis project titled *Using Similarity to Accelerate the Primal-Dual Hybrid Gradient Algorithm for Linear Programming.*

Max was part of organizing the Deep Learning module for WASP.

His paper *The symmetry coefficient of positively homogeneous functions* was accepted in Optimization Letters.

Nishimura, Mika
Born in Japan. Administrator at the department since January 2014.

She handles Ladok (student administration system) for both students and PhD students. She has contact with the printing office about publications, and is responsible for purchase of office supplies, books and handles Lucat-catalogue system for the employees and the guests at the department. In addition, she reviews Lucris-research portal, updates LUP-student paper and parts of the web pages as well as other service-oriented tasks.

Norlund, Frida
She obtained her MSc in Engineering Physics from Lund University, 2022. Since September 2022 she is an industrial PhD student at the department.

She is employed by Boliden AB and her research interests are within data driven modeling and control of the flotation process.

Nyberg Carlsson, Max
MSc in Engineering Physics (2021) at LTH. PhD student since August 2021 as a part of an ELLIIT funded project. WASP affiliated as a part of class 2022.

His research topic is on exploiting the infinite resources of cloud computing for use in control, mainly investigating timing aspects. In 2025, focus was on aperiodic control.

Teaching duties were *Real-Time Systems* in the spring, and during the fall he helped develop, teach, administrate and upscale the new *Cloud Computing* course.

Ohlin, David
MSc Engineering Physics (2021), LTH and PhD student since 2021. David defended his Licentiate Thesis entitled *Positive Network Systems: Heuristic Methods and Opinion Dynamics* in September

2024. He is supervised by Emma Tegling and Anders Rantzer. He is part of the WASP NEST project *Learning in Networks: Structure, Dynamics, and Control.*

His current research focuses on scalable optimal control of positive networks. Other interests include the modeling of opinion dynamical systems as nonlinear positive networks.

Teaching responsibility in 2025 is comprised of course development and teaching assistance for the masters-level course in *Learning-Based Control.*

During part of the fall, he spent time with the research group of Farhad Farokhi as a visiting scholar at University of Melbourne.

Olofsson, Björn

He obtained his PhD in Automatic Control in 2015, from Lund University, and was appointed Docent at Linköping University in 2020. He has been with the department since 2010. He is, since May 2022, a Senior Lecturer and since November 2022 Director of Undergraduate Studies.

Björn has broad research interests in motion planning and control for autonomous robots and vehicles.

During the year, he has been involved in research projects within the ELLIIT Strategic Research Area and the Wallenberg AI, Autonomous Systems and Software Program. He has also taken active part in the teaching activities at the department. He was responsible for the courses *Applied Robotics* and *Applied Robotics for Architects* during the fall semester.

He was also acting as supervisor and examiner of several Master's Theses during the year. He is the main supervisor of three PhD students and co-supervisor of three PhD students at the department. He is in addition co-supervisor of one PhD student at Department of Computer Science, one PhD student at Department of Architecture and Built Environment, and one PhD student at Division Vehicular Systems, Linköping University.

Pates, Richard

Richard received his PhD degree in 2014 from the University of Cambridge. He has been an Associate Professor in the Department of Automatic Control since 2020.

He has broad interests in automatic control, with a particular focus on the control of electrical power systems.

He is currently the main supervisor for four PhD students and an assistant supervisor for a further two. In addition, in the academic year 2024-2025 he supervised four master's thesis students, taught the *Control Theory* course, taught the *Advanced Control* course and taught the PhD level course on *Robust Control.*

Pisarevskiy, Alexander

DipEng in Optoelectronics (2009). Research Engineer since 2020.

He is primarily involved in upgrading laboratory equipment for educational purposes.

In 2025 he worked on the development of systems for remote learning, including solutions for conducting remote laboratory experiments. During the same year, he also worked on real-time systems based on FreeRTOS, participated in the preparation for the Swedish Control Conference 2025, and contributed to several Master's thesis projects.

Rantzer, Anders

Professor of Automatic Control since 1999. Anders is the main supervisor for several PhD students and postdocs.

He has broad interests in modeling, analysis and synthesis of control systems, with particular attention to uncertainty, optimization, scalability and adaptation.

During 2025, he taught the masters level courses *Learning-based Control* and *Modeling and Learning from Data.*

A highlight of 2025 was that he was awarded a second Advanced Grant from Europan Research Council. Another highlight was that he was appointed Honorary Chair professor of National Sun Yat-sen University in Taiwan, where three of his former postdocs serve as faculty members.

Rasmusson, Monika
She joined the department in August 2011 and as from March 2017, she took over as finance officer. She is responsible for year-end closing, budget, forecasts and reporting, both internally within the faculty and externally to sponsors.

As a part of the administrative team, her work includes backup function for her colleagues, editing the yearly Activity Report, among other administrative tasks.

She is a member of the Department Board and also a member of the nomination committee.

Rydén, Karl
MSc in Engineering Mathematics from Lund University, 2025. PhD student since August 2025.

His research interests include data-driven adaptive and dual control.

During the latter part of the year he has been involved in teaching the course *Modelling and learning from data*.

Sinnema, Yde
MSc in Electrical Engineering, Vrije Universiteit Brussel and Université Libre de Bruxelles, Belgium in 2023. He joined the department as a PhD student in September that year. His main supervisor is Martina Maggio.

His research interests concern uncertainties related to the implementation of control systems.

He was involved as a teaching assistant in the courses *Real-time Systems* and *Learning-based Control* and *Modelling and Learning from Data*.

Soltesz, Kristian
PhD in Automatic Control at Lund University in 2013, based on research conducted at University of British Columbia. Since 2019 Kristian is Reader (Docent) in Automatic Control, with research focus on medical models and control systems.

His main research interest is modeling and control of cyber-physiological systems.

His research projects during 2025 involved technological methodology development for improved heart transplantations, data-driven methods for sustainable mining of minerals, and novel methodologies for individualized pharmacological modeling.

During the year he was the main advisor of doctoral students Ylva Wahlquist (graduated March 2025), Frida Norlund, Erik Steen, and postdoc Jesper Sundell. He was also co-advisor to PhD students Martin Gemborn Nilsson and Emil Sundström.

Stenberg, Oskar
Research Engineer at the department since September 2024, currently writing his thesis for his MSc in Computer Science.

Responsibilities include the electrical and mechanical workshop, general computer and server maintenance as well as maintenance and development of software for the department. He has upgraded our 3D-printers, organized and restructured the workshop, and worked on a major network upgrade for the robotlab.

Current projects include a collaboration with other universities to develop new lab processes, amongst which is a new version of the quadtank-lab, as well as automatic testing for changes within our server environment.

Sundell, Jesper
He joined the department as a postdoc in April 2022 to work in the project entitled Learning pharmacometric model structures from data.

Jesper holds a PhD in quantitative pharmacology with a focus on model-based drug development, which he obtained in 2021 at Gothenburg University.

Research interests include pharmacometrics, precision medicine and machine learning.

He also works as an advisor in a project related to the antitubercular drug rifampicin. The project involves a clinical study which is conducted in Västra Götalandsregionen. His employment ended in September.

Sundström, Emil
MSc in Engineering Physics program, 2022. He has worked as a control systems consultant at Combine Control Systems until November 2023,

when he started as PhD at the department.

His research focus is on control systems strategies for autonomous vehicles, specifically how cloud computing and offloading can improve performance of computationally heavy control algorithms.

Teaching assignments under the year include courses in *Learning-Based Control*, *Physiological Modelling*, and *Cloud Computing*.

Tegling, Emma

PhD in Electrical Engineering from KTH Royal Institute of Technology, Sweden, 2019. She was a postdoc at Massachussetts Institute of Technology before becoming Senior Lecturer (associate professor) in 2021. She is Deputy Head of Department since 2024.

Emma's research revolves around analysis and control of network systems. Together with her research group, she is interested in fundamental questions regarding scalability, robustness and controllability of systems defined over networks, and in applications including energy systems and social networks.

During 2025, Emma was awarded a starting grant from the Swedish Research Council (VR) for her project *Dynamic Fragilities in Societal-Scale Networks*.

She is also one of the leaders of the WASP NEST (Novelty, Excellence, Synergies and Teams) project on Learning in Networks, which is a collaboration with KTH and Uppsala University. In November 2025 she visited the University of Melbourne, supported by the LU Initiative GloHUB.

Emma spent the beginning of 2025 on parental leave.

She is supervising several PhD students and MSc students.

Tufvesson, Pex

MSc in Electrical Engineering in 1997 from LTH. Since then he has been working as a chip designer on GPUs, supercomputing, communication systems, encryption and synthesizers.

He has founded startups doing wearables and child healtcare systems. Employed by Ericsson Research, and in 2021 he started as an industrial PhD student at the Department of Automatic Control.

In November, he defended his thesis entitled *Real-Time Brain-Computer Interfaces*.

Upadhyaya, Manu

MSc in Engineering Physics, 2020, Lund University and MSc in finance, 2020, Lund University. He is a PhD student since July 2020.

His research focuses on continuous optimization and its applications in machine learning, control, and finance, with an emphasis on designing and analyzing first-order methods for convex optimization and monotone inclusion problems. He defended his thesis in September with the title *Lyapunov analyses for first-order methods: Theory, automation, and algorithm design*.

Vladu, Emil

MSc in Engineering Physics from Lund University, 2018. PhD student at the department since August 2019.

In June, he defended his thesis with the title *On Performance Guarantees for Systems with Conic Constraints*.

Voitenko, Volodymyr

PhD in Technical Sciences, Docent, Associate Professor in the Department of Electronics, Automation, Robotics and Mechatronics at the Chernihiv Polytechnic National University (Ukraine) and Honorary Professor of the same University in Chernihiv.

He is the Principal Investigator in the project *Subsystem for two-coordinate positioning of the UAV auxiliary video camera (2DCAM).* He is also a visitning researcher in the project *Image Preprocessing and Object Detecting UAV System*

Volodymyr has been teaching at the Chernihiv Polytechnic National University, Ukraine the following courses: *Digital Image Processing, Display systems and Industrial Controllers*.

He is supervising PhD student Maksym Solodchuk (Chernihiv Polytechnic National University, Ukraine).

Wahlquist, Ylva
MSc (2019) and PhD student at the department since May 2020.

Her research interests include pharmacometric modeling and control of hemodynamic parameters for intensive care and heart transplantation, in collaboration with the research company Igelösa Life Science.

In March she defended her thesis with the title *Modeling and Control of Pharmacological Systems*.

Westin, Eva
PhD in French linguistics. Administrator at Automatic Control since 2008 and administrative manager from 2017 for the administrators and research engineers at the department.

She handles the overall responsibility of human resources, guests and conferences. She also handles part of the process for research studies.

Eva is part of the steering group for AI Lund and she is also a member of the LTH Board.

The last few years she has participated in the project *Female Influencers in Automatic Control* together with professors Charlotta Johnsson and Margret Bauer.

Wisbrant, Jonas
Jonas has an academic educational background in political science, software development and strategic communication.

Within the framework of the AI Lund network and Lund University's profile area for natural and artificial cognition, Jonas runs strategic and operational communication, networking and public education.

Wu, Dongjun
Dongjun is a postdoc researcher under the supervision of Professor Anders Rantzer, funded by the ERC project *Scalable Control of Large Scale Systems*. He has been in the department since April 2022. Prior to that, he obtained a joint PhD degree from University of Paris-Sacaly and Harbin Institute of Technology.

His research focuses on large scale systems, optimal transport and nonlinear control. In particular, he is interested in applying control theory and tools to solve dynamical optimal transport problems.

He taught a PhD level course *Robust Control* (October - November 2025). He has been co-supervising PhD candidate Emil Vladu with Anders Rantzer, and Master student Guilherme Junqueira Perticarari together with Professor Thierry Baasch from Department of Biomedical Engineering, LTH. Both of them have successfully defended their thesis.

He attended two conferences this year, CCDC in Xiamen, China (May. 2025) and CDC in Rio de Janeiro, Brasil (Dec. 2025).

Ziemann, Ingvar
MSc in Mathematics (2018), joint with KTH and Stockholm University. MSc in Economics (2017), Stockholm School of Economics and PhD in Decision and Control (2022), KTH. He ended his postdoc position at UPenn in June, which was funded by a VR grant managed by Lund.

AWARDS

GRANTS

Travel grant from the Royal Physiographic Society

Alba Gurpequi Ramón was awarded a grant for Young Researchers – PhD Students endowment to cover the costs of attending NecSys 2025, Hong Kong.

Mark Jeeninga was awarded the Young Researchers grant of 25 000 kr to attend the 10th IFAC Conference on Networked Systems (NecSys25) in Hong Kong in June 2025, where a paper was presented.'

GloHUB funding

Emma Tegling was awarded, for exchange with University of Melbourne, Australia on the project Information propagation on sociotechnical networks, from the GloHUB Seed funding for research and education collaboration.

ASSIGNMENTS

BOARD MEMBER

Årzén, Karl-Erik

Chair of the Research Management Group for the Wallenberg Autonomous Systems and Software Program (WASP).

Member of the WASP Executive Committee.

Member of the Strategic Advisory Board for the Department of Electrical Engineering, Aalto University.

Chair of the Department board.

Chair of the board for the LTH RobotLab.

Eker, Johan

Chairman of the Advisory Board for *Sustainable Digitalization Research Center* at Malmö University.

Johnsson, Charlotta

Chair of the Board for IIIEE (International Institute for Industrial Environmental Economics) at Lund University, Sweden.

Board member of EFL (Executive Foundation Lund), Lund, Sweden.

Board member of Innovation Skåne AB, Sweden.

Board member of IUC Syd (Industriellt utvecklingscentrum Syd), Malmö, Sweden.

Board member of Novotek AB, Malmö, Sweden.

Board member of Campus Vänner, Helsingborg, Sweden.

Board member at Helsingborg Innovations District, Helsingborg, Sweden.

Board member of Haakon Hanssons Stiftelse.

Board member of X-Lab, Lund University.

Board member of Campus Helsingborg, Lund University.

Other Board assignments in national and international companies.

Rantzer, Anders
One of two co-directors for the ELLIIT focus period program.
2nd Vice Chairman for the Royal Physiographic Society of Lund.
Member of the Steering Committee for the International Symposium on Mathematical Theory of Networks and Systems.
Member of Editorial Board for the journal Annual Reviews in Control.
Member of WASP research management group for Mathematics in AI.
Member of Executive Council for European Control Association

Tegling, Emma
Member of the Board of Governors, IEEE Control Systems Society

Westin, Eva
Member of the Board for AI Lund.
Member of the Board at the Faculty of Engineering since 2022.

Wisbrant, Jonas
Member of the Board for AI Lund.
Member of the steering group for NAC (Natural and Artificial Cognition).

MEMBER OF INTERNATIONAL PROGRAM COMMITTEE (IPC) AND ORGANIZING COMMITTEES

Bernhardsson, Bo
Member of the Organizing Committee for the WASP-DDLS (Data-driven Life Science) synergy project.

Johnsson, Charlotta
Member in the IFAC Activity Fund Committee, focus on IFAC's outreach activities.

Maggio, Martina
Member of Technical Program Committee for ICCPS 2025
Member of Technical Program Committee for ECRTS 2025
Member of Technical Program Committee for Opera 2025
Member of Technical Committee for the evaluation of the Best Paper at ECC 2025
Member of Technical Committee for the evaluation of Workshops for CDC 2025
Member of Technical Committee for the evaluation of the Special Sessions at EMSOFT 2025
Member of Technical Committee for the Test of Time Award Assignment for the Technical Committee on Real-Time Systems 2025

Pates, Richard
Member of the Control System Society Technical Committee on Power Generation.

Tegling, Emma
Vice program chair, IEEE CDC 2028.

OPPONENT AND MEMBER OF EXAMINATION COMMITTEE

Årzén, Karl-Erik
Opponent of PhD Thesis by Achilleas Santi Seisa, Luleå University of Technology, December 1

Bernhardsson, Bo
Member of PhD examination committee for Ruoqi Zhang, Department of Information Technology, Uppsala University.
Member of PhD examination committee for Emanuel Sanchez Aimar, Department of Electrical Engineering, Linköping University.
Substitute Member of the PhD examination committee for Ashkan Sheikhi at the Department of Electrical and Information Technology (EIT), LTH.

Eker, Johan
External evaluator of PhD Thesis by Chuanchao Gao, Nanyang Technological University, Singapore, in November.
Opponent of Licentiate Thesis by Ali Nada, Halmstad University, in June.

Giselsson, Pontus
Member of PhD examination committee for Firooz Shahriari Mehr, Chalmers, Dec 17.
Opponent of PhD Thesis by Shamisa Shoja, Linköping University, Apr. 24.
Member of PhD examination committee for Ali Dadras, Umeå University, March 12.
Member of PhD examination committee for Lujing Chen, DTU, Copenhagen, Jan 21.

Karayiannidis, Yiannis
Opponent of the PhD Thesis: *Perception and Planning for Dual-arm Robotic Manipulation of Multi-Deformable Linear Objects in Wire Harness Assembly* by Pablo Malvido Fresnillo, Tampere University, Tampere, Finland, September.
Opponent of the Licenciate Thesis: *Towards Autonomous Collaborative Aerial 3D Printing* by Marios Nektarios Stamatopoulos, Deptartment of Computer Science, Electrical and Space Engineering, Luleå University of Technology Luleå, Sweden, June.
Member of PhD examination committee of the Thesis: *Robotic Learning for Perception and Manipulation of Deformable Objects* by Kevin Galassi, University of Bologna, (May 2025) under the Italian National PhD program in AI at the Polytechnic of Turin.

Maggio, Martina
PhD Reviewer for Italo Fantozzi, University of Rome, Tor Vergata.
PhD Reviewer for Lukas Miedema, University of Amsterdam.
PhD Reviewer for Ismail Hawila, Sorbonne Université.

Olofsson, Björn
Opponent of PhD Thesis by Daniel Gleeson on October 27, Division of Automation, Department of Electrical Engineering, Chalmers University of Technology, Sweden. Thesis title: *Trajectory Optimization including Robot Controller Emulation.*
Opponent of Licentiate Thesis by Ektor Karyotakis on May 9, Division of Mechatronics, Department of Electrical Engineering, Chalmers University of Technology, Sweden. Thesis title: *Braking Distance Minimization on Roads with Varying Friction.*

Member of PhD grading committee for Xiao Chen, on April 4, Division of Decision and Control Systems, KTH Royal Institute of Technology, Sweden. Thesis title: *Coordination for safe interactions of connected and automated vehicles on highways and intersections*.

Rantzer, Anders
Member of PhD examination committee for Aren Karapetyan, ETH Zürich, June 17.
Member of PhD examination committee for Martin Lundberg, Lund University, October 3.

Tegling, Emma
Member of examination committee for Yuexin Cao, KTH.
Member of examination committee for Martina Alutto, Politecnico di Torino.
External examiner for Magnus Axelson-Fisk, Berlin Institute of Techology.

ADVISORY COMMITTEES AND WORKING GROUPS

Årzén, Karl-Erik
Elected member of the Royal Swedish Academy of Engineering Sciences (IVA).

Bernhardsson, Bo
Member of the AI Lund coordination group.

Johnsson, Charlotta
Part of UD:s referensgrupp för internationell standardisering (Referece group for international standardization, Ministry for Foreign Affairs, Sweden).
Chair of ISO TC184/SC5 (Industrial Automation / Interoperability, integration and architectures for enterprise systems and automation applications).
Member in ISO SMCC (Smart Manufacturing Coordination Committee), reporting directly to ISO Technical Management Board.
Voting member in the standardization committee ISA95 and ISA88.
Board member for Diploma Engineering at University of Limerick, Ireland.
Member in SIS and SEK. She serves as the Swedish expert in the international IEC 62264, IEC 61512, ISO 22400 and ISO 15746 standards, as well as in the groups IEC AhG3, IEC TC65E AhG1, as well as in the joint committee IEC/TC65-ISO TC184 JWG21.
Part of IFAC Activity Fund committee (international Federation of Automatic Control).
Part of IEEE Control System Society Industry Committee (IEEE CSS).
Part of ELLIIT Gender and Diversity Group.
Member of several working groups at Lund University, e.g Samverkansrådet Lund University.

Maggio, Martina
Program Chair: International Conference on Embedded Software (EMSOFT 2025).
Program Committee Membership: Euromicro Conference on Real-Time Systems (ECRTS).

Olofsson, Björn
Co-organized together with Lars Nielsen, Linköping University, a pre-symposium tutorial on the topic *Numerical Optimal Control for Vehicles* in connection with the 11th IFAC Symposium on Advances in Automotive Control AAC 2025 – Eindhoven, Netherlands, 16-18 June 2025.

Co-organized the ELLIIT Focus Period and Symposium on Robot Learning during November-December 2025.
Co-organized and participated in the EU Robotics Week during November 2025, with presentations and demos for visiting schools, companies, and the general public.

Pates, Richard
Member of the Council of the European Control Association.

Rantzer, Anders
Member of review panel for projects funded by the European Research Council.
Member of Evaluation Committee for Wallenberg Academy Fellows.
Advisory Editor for Lecture Notes in Control and Information Sciences at Springer Verlag Heidelberg.
Member of the IEEE Control System Society Technical Committee on Nonlinear Systems and Control.
Member of the IFAC Technical Committee on Nonlinear Systems.

Voitenko, Volodymyr
Part of organizing and holding of the XX International Conference MODS-2025 November 10-12.
Part of organizing and holding of the V International Scientific and Practical Conference *Novel Technologies of Smart Society* NTSS-2025, December 12.

OTHER ASSIGNMENTS

Årzén, Karl-Erik
WASP co-director for research program coordination.
Associate Editor for Real-Time Systems Journal.
Associate Editor for ACM Transactions of Cyber-Physical Systems.

Eker, Johan
Project manager WARA-OPS (wara-ops.org), 2023 - 2025.
Member Swedish Science Council (VR) EuroHPC Reference group 2023 — 2025.
Co-organised the 1st Capri PhD School on *Cyber Physical Cloud*, Anacapri, Capri Island, Italy
Co-organised 4th *Real-time Cloud* workshop at ECRTS in Brussels, July.

Edelborg, Cecilia
Member of the Group for Gender Equality and Equal Opportunities (JäLM) at the Faculty of Engineering.

Johnsson, Charlotta
Serving as the IFAC Liaison with IEC 65A.
Serving as a member in IEEE CSS Industry Committee.

Karayiannidis, Yiannis
Associate Editor for IEEE/ASME Transactions on Mechatronics since August 2024
Organizer of the ELLIIT Focus Period on Robot Learning, Lund Nov 3 to Dec 5, and responsible for the associated PhD-level mini-course *Topics in Robot Learning*.

Maggio, Martina
Associate Editor For ACM Transactions on Cyber Physical Systems and for ACM Transaction on Embedded Systems

Pates, Richard
Associate Editor for Control Systems Magazine.

Rantzer, Anders
Honorary Chair Professor of National Sun Yat-sen University in Taiwan
Director for the guest program within ELLIIT

Soltesz, Kristian
Director of the program board for Engineering Physics, mathemastics, and two master programs at Lund University.

Tegling, Emma
Co-organized the NAC workshop *How Networks Work* at Lund University in May.

Westin, Eva
Coordinator of the ELLIIT Focus Program since 2022.

LONGER VISITS ABROAD

Bencherki, Fethi
From March to June 2025, Fethi conducted a research visit at the Electrical and Systems Engineering Department, University of Pennsylvania, where he was collaborating on topics at the intersection of learning and control for networked systems.

Maggio, Martina
In April 2020, Martina Maggio started a double appointment as full professor at the Department of Computer Science of Saarland University, Germany. During 2025 she had only 20% duty at the Department of Automatic Control, Lund University.

Ohlin, David
From mid October 2024 to end of January 2025, David was on a research visit hosted by Professor Murat Arcak and his group at the Department of Electrical Engineering and Computer Sciences, University of California. His visit was financed through the WASP PhD student exchange program within the framework of WASPs Memorandum of Understanding.

Upadhyaya, Manu
From September to February 2025, Manu Upadhyaya spent a research stay with the Sierra team at Inria Paris, hosted by Francis Bach and Adrien Taylor, to further his work on advanced optimization methods.

LECTURES BY OUR PERSONNEL OUTSIDE THE DEPARTMENT

Eker, Johan

Invited talk in the *Real-time Scheduling* course at RTPU, Kaiserslautern, July.

Invited talk at 1st Workshop on *End-to-End Analysis and Optimization of Task Chains,* Turin, November.

Invited lecture at the *WASP Cloud* course at Umeå University, April.

Johnsson, Charlotta

Smart manufacturing, presentation for ALICIA research project.

The importance of female role-models in STEM, presentation at ELLIIT Gender and Diversity seminar-series, March 14.

The importance of female role-models in STEM, March 19, presentation at NMT-days 2025, Lund University.

Best in class – on the creation and impact of the project Historical Female Influencers in Automatic Control, October 15, Lise-Meitner day, Lund University.

Historical Female Infleuncers in Automatic Control, recorded Nov 26, inControl podcast.

Trailblazing Women in Control, Dec 10, Rio de Janeiro, Brazil.

Rantzer, Anders

Towards Optimal and Adaptive Control for Large-scale Systems, Invited seminar at TU Darmstadt, April 29.

Towards Optimal and Adaptive Control for Large-scale Systems, Invited lecture at Peking University, China, May 13.

On the Interplay Between Learning and Large-scale Control}, Keynote lecture at 37th Chinese Control and Decision Conference, Xiamen, China, May 17.

On the Interplay Between Learning and Large-Scale Control, Invited lecture at National Sun Yat-sen University, Kaohsiung, Taiwan, May 19.

On the Interplay Between Learning and Large-Scale Control, Invited lecture at Taipei University, Taipei, Taiwan, May 23.

Optimal and Dual Control for Large-scale Systems, Invited lecture at ETH, Zürich, Switzerland, June 16.

On Minimax Optimal Dual Control for Fully Actuated Systems, American Control Conference, Denver, USA, July 10.

On the Interplay Between Learning and Large-Scale Control, Seminar at University of Minnesota, Minneapolis, USA, July 14.

On the Interplay Between Learning and Large-Scale Control, Invited lecture at Uppsala University, Uppsala, October 14.

Optimal Control on Positive Cones, Invited lecture at Uppsala University, Uppsala, October 14.

Optimal and Dual Control for Large-scale Systems, Webinar organized by the International Federation of Automatic Control, October 29.

Optimal Control on Positive Cones, Invited lecture at Control Workshop Uruguay 2025, Montevideo, Uruguay, December 6.

Minimax Optimal Adaptive Control for Systems on Cones, American Control Conference, Rio de Janeiro, Brazil,December 11.

Westin, Eva

The importance of female role-models in STEM, presentation at ELLIIT Gender and Diversity seminar-series, March 14.

The importance of female role-models in STEM, March 19, presentation at NMT-days 2025, Lund University.

Best in class – on the creation and impact of the project Historical Female Influencers in Automatic Control, October 15, Lise-Meitner day, Lund University.

Historical Female Infleuncers in Automatic Control, recorded Nov 26, inControl podcast.

Trailblazing Women in Control, Dec 10, Rio de Janeiro, Brazil.

POPULAR SCIENCE

Johnsson, Charlotta

Bindningstid, magasin Aakermount (contribution from C.Johnsson and M.Adenskog), April 2025.

Historical Women Influencers in Automatic Control, Pettersen K. Ozay N., Johnsson C., Westin E., Bauer M., IEEE Control Systems Magazine (Volume 45, Isuse 2, p.13-18), ISSN 1066-033X, DOI: 10.1109/MCS.2025.3534936, April 1.

Westin, Eva

Historical Women Influencers in Automatic Control, Pettersen K. Ozay N., Johnsson C., Westin E., Bauer M., IEEE Control Systems Magazine (Volume 45, Isuse 2, p.13-18), ISSN 1066-033X, DOI: 10.1109/MCS.2025.3534936, April 1.

Lundakarneval, 22-24 May 2026 ”Celestial”