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MASTER THESES IN AUTOMATIC CONTROL 1980/81

LARS PERNEBO

DEPARTMENT OF AUTOMATIC CONTROL  
LUND INSTITUTE OF TECHNOLOGY  
NOVEMBER 1981

<b>LUND INSTITUTE OF TECHNOLOGY</b> DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name	
		MS theses report	
		Date of issue	
Author(s)  Lars Pernebo		Document number	
		CODEN: LUTFD2/(TFRT -6012)/1-19/(1981)	
		Supervisor	
		Sponsoring organization	
Title and subtitle Master theses in Automatic Control 1980/81			
Abstract  The report contains abstracts of master theses (examensarbete) made at the department of Automatic Control, Lund, during the academic year 1979/80. During this year 12 theses were made by 15 students. The theses are written in Swedish with an English abstract.			
Key words			
Classification system and/or index terms (if any)			
Supplementary bibliographical information			
ISSN and key title			ISBN
Language	Number of pages	Recipient's notes	
English	19		
Security classification			

Distribution: The report may be ordered from the Department of Automatic Control or borrowed through the University Library 2, Box 1010, S-221 03 Lund, Sweden, Telex: 33248 lubbis lund.

## 1. INTRODUCTION

The education for civilingenjörsexamen (Master Degree in Engineering) is completed with an independent work, the master thesis (examensarbete). It should show the student's ability to attack and solve a larger problem. The time devoted to the thesis is about three months of full time work. The thesis can be done individually or by two students together.

This report is a collection of the document pages of the theses completed during the academic year 1980/1981. During this time 12 theses were finished by 15 students. The major part of the theses is made within the framework of the research program at the department. Some of the theses are made as feasibility studies or made in cooperation with the industry or other departments.

Further information concerning the results can be obtained from the Department of Automatic Control by contacting the advisor. The theses are available at the University Library in Lund (Address: University Library 2, Box 1010, S-221 03 LUND, Sweden).

## 2. LIST OF THESES

- TFRT-5236      INGVAR BÄCKESTRAND: Extremalsökande regulatorer  
(Extremal seeking regulators).  
August 1980.
- TFRT-5237      CHARLOTTE STALIN: Elektrohydrauliskt Bromssystem  
(Electro-hydraulic braking system)  
August 1980.
- TFRT-5238      LENNART MÅNSSON: CONDIS - En vidareutveckling av  
simuleringspaketet Combinedsimulation  
(CONDIS - A development of the simulation package  
COMBINEDSIMULATION)  
April 1980.
- TFRT-5239      SVEN LIDEMYR: MÄTGIVAREDYNAMIK. Modellering,  
simulering och experimentell validering av system-  
dynamik för ett kopplat nivåmätsystem i en BWR  
anläggning  
(Transmitter Dynamics. Modelling, simulation and  
experimental verification of system dynamics for  
a coupled level measuring system in a BWR plant)  
September 1980.
- TFRT-5240      ANDERS HELLAEUS: Experiment med självinställande  
PID-regulator  
(Experiment with self-tuning PID-controller)  
August 1980.
- TFRT-5241      ANDERS FREIJ, SÖREN ROMARE: Fartygsstyrning vid  
sjögång  
(Automatic steering of ships in heavy seas)  
October 1980.
- TFRT-5242      JAN SWIETLICKI, ANDERS WALLENBERG: Analys av insulin-  
glukos dynamik  
(Analysis of insulin-glucose dynamics)  
December 1980.

- TFRT-5243      GÖRAN OLESKOG: Cellcykelsimulering  
(Cell cycle simulation)  
March 1981.
- TFRT-5244      BENGT LEVIN: Eliminering av störningar vid  
försegling med ultraljud  
(Elimination of disturbances at sealing with  
ultrasound)  
March 1981.
- TFRT-5245      ANDERS HELMERSSON: Dual reglering - En optimal  
dual regulator för en integrator med konstant  
men okänd förstärkning  
(Dual control - An optimal dual regulator for an  
integrator plant with constant but unknown gain)  
March 1981.
- TFRT-5246      HENRIETTE WEIBULL: Some Programs for Frequency  
Analysis in IDPAC  
April 1981.
- TFRT-5247      JAN-ÅKE MÅNSSON, STEN-ÅKE BERGMAN: Simulering av  
fjärrvärmenät  
(Simulation of a district heating system)  
April 1981.

### 3. LIST OF SUBJECTS

<u>Subject</u>	<u>Thesis</u>
Modelling and simulation	5237, 5239, 5247
Adaptive control	5236, 5240, 5241, 5245
Biological systems	5242, 5243
Computer programs	5238, 5246
Analysis and synthesis	5244

#### 4. DOCUMENT PAGES

The following pages contain the document pages of the theses. All theses, except one, are written in Swedish with an abstract in English. One (TFRT-5246) is written in English.



Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control P O Box 725 S-220 07 LUND 7, Sweden		Document name <b>MASTER THESIS</b>	
		Date of issue <b>August 1980</b>	
		CODEN: LUTFD2/(TFRT-5236)/1-044/(1980)	
Author(s) <b>Ingvar Bäckstrand</b>		Sponsoring organization	
Title and subtitle <b>Extremalsökande regulatorer</b> <b>(Extremal seeking regulators)</b>			
		A4	A5
Abstract <p>Three discrete time algorithms for <u>extremum control</u> are tested on simulated systems. The model contains a linear dynamic part of at most second order with a static quadratic nonlinearity attached to obtain the measured output. The ability to locate and stay at the extremum point with and without process disturbances is investigated. Slow control is gained by the <u>perturbation</u> and <u>stepping</u> methods. A slight modification of the stepping method shows great similarities with a simple form of the <u>self-driving method</u> and these also give faster control. Methods to get insensitivity to disturbances are also suggested and tested on the different algorithms. This has not changed the relative behaviour of the methods.</p>			
Key words		A4	A5
Classification system and/or index terms (if any)			
Supplementary bibliographical information			Language <b>Swedish</b>
ISSN and key title			ISBN
Recipient's notes		Number of pages 44	Price
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Distribution by (name and address)			

Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control P O Box 725 S-220 07 LUND 7, Sweden		Document name MASTER THESIS	
		Date of issue AUGUST, 1980	
		CODEN:LUTFD2/(TFRT-5237)/1-170/(1980)	
Author(s) Charlotte Stalin		Sponsoring organization	
Title and subtitle Elektrohydrauliskt bromssystem (Electro-hydraulic breaking system)			
Abstract			
<p>SAB Industry AB is today working on the development of electro-hydraulic brake systems. With respect to the application time they are superior to other types of systems.</p> <p>The aim of this work was to calculate and simulate the transfer-fuction for a system of this type.</p> <p>While the system was non-linear it was not possible to put up any transfer function. In Simnon (the programming package used) it is however possible to simulate non-linear systems, and models with dynamics similar to the real systems has been built.</p> <p>The application for this sort of model-building is in the early stage of construction. In this way it is possible to test ideas without building expensive prototypes, and both money and time can be saved.</p>			
Key words			
Classification system and/or index terms (if any)			
Supplementary bibliographical information		Language Swedish	
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Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control P O Box 725 S-220 07 LUND 7, Sweden		Document name MASTER THEIS	
		Date of issue APRIL 1980	
		CODEN: LUTFD2/(TFRT-5238)/1-119/(1980)	
Author(s) Lennart Månsson		Sponsoring organization	
Title and subtitle CONDIS - En vidareutveckling av simuleringspaketet Combinedsimulation (CONDIS - A development of the simulation package Combinedsimulation)			
Abstract		A4	A5
<p>Extensions of the simulation package Combinedsimulation is given in the report. Combinedsimulation is suited for simulation of differential and difference equations in combination with events.</p> <p>There are two main extensions done in Condis. First a fourth order predictor corrector method is used for the integration. Secondly, new ways to continue a run is done by changing the error and exit handling.</p>			
Key words		A4	A5
Classification system and/or index terms (if any)			
Supplementary bibliographical information			Language Swedish
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	Security classification		
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Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control Box 725 S-220 07 LUND 7 SWEDEN		Document name Master thesis	
		Date of issue September 1980	
		CODEN: LUTFD2/(TFRT-5239)/1-077/(1980)	
Author(s) Sven Lidemyr		Supervisor: Sten Bergman	
Title and subtitle Mätgivardynamik (Transmitter Dynamics. Modelling, simulation and experimental verification of system dynamics for a coupled level measuring system in a BWR plant)			
Abstract			
<p>In this thesis a modelling of a parallel level measuring system is done. The system consists of relatively long water tubes, so called impulse tubes, and two sorts of pressure difference transmitters. The nonlinear model is studied by means of simulation. Since the models of the pressure difference transmitters have a great influence on the model of the level measuring system, an adaptation of these models has been carried out with experiments and simulations.</p>			
Key words			
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Supplementary bibliographical information			Language Swedish
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		Date of issue August 1980	
		CODEN: LUTFD2/(TFRT-5240)/1-027/(1980)	
Author(s) Anders Hellaeus		<del>Sponsoring organization</del> Supervisor: Björn Wittenmark	
Title and subtitle Experiment med självinställande PID-regulator (Experiment with self-tuning PID-controller)			
Abstract		A4	A5
<p>An algorithm, STUPID, for a self-tuning PID-controller based on pole-placement has been constructed on the Department of Automatic Control. The algorithm has been implemented on an LSI-11.</p> <p>This master thesis considers tests of STUPID on an analog computer, an electric servo and a level control system. Comparisons between STUPID and a traditional PID-controller on the processes above have been done.</p>			
Key words		A4	A5
Classification system and/or index terms (if any)			
Supplementary bibliographical information		Language Swedish	
ISSN and key title		ISBN	
Recipient's notes	Number of pages 27		Price
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Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control Box 725 S-220 07 Lund 7      Sweden		Document name Master thesis	
		Date of issue October 1980	
		CODEN: LUTFD2/(TFRT-5241)/1-80/(1980)	
Author(s) Anders Freij Sören Romare		Supervisor: K J Åström	
Title and subtitle Fartygsstyrning vid sjögång (Automatic steering of ships in heavy seas)			
Abstract		A4	A5
<p>This paper deals with automatic steering of ships under the influence of disturbance from waves. The disturbance has been of two different types, a sinusoidal wave and a disturbance in the yaw rate. We have used both conventional state feedback regulators and adaptive regulators based on least square estimation and minimum variance control. In particular, we have investigated the behavior of the adaptive regulator in quarterly seas. Different ways to improve the performance of the regulators have been tested. Additional proposals for improvements which are not yet tested, have also been given.</p>			
Key words		A4	A5
Classification system and/or index terms (if any)			
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ISSN and key title		ISBN	
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Organization <b>LUND INSTITUTE OF TECHNOLOGY</b> Department of Automatic Control Box 725 S-220 07 Lund 7 SWEDEN		Document name Masters thesis	
		Date of issue December 1980	
		CODEN: LUTFD2/(TFRT-5242)/1-32/(1980)	
Author(s) Jan Swietlicki Anders Wallenborg		Supervisor: Per Hagander	
Title and subtitle Analys av insulin-glukos dynamik (Analysis of insulin-glucose dynamics)			
Abstract			
<p>The structure and usage of PAGIC 80, a program system for analysis of plasma glucose, insulin, and C-peptide responses to different insulin secretory stimuli in man, is described.</p> <p>Simple dynamic models for the plasma glucose response to an injection of glucagon and the insulin/C-peptide response to an intravenous glucose tolerance test (IVGTT) are discussed and fitted to experimental data.</p>			
Key words			
Classification system and/or index terms (if any)			
Supplementary bibliographical information			Language SWEDISH
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<b>LUND INSTITUTE OF TECHNOLOGY</b> DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name	
		Master thesis	
		Date of issue	
		March 1981	
Author(s)		Document number	
		CODEN: LUTFD2/(TFRT-5243)/1-055/(1981)	
		Supervisor	
Göran Oleskog		Per Hagander	
		Sponsoring organization	
Title and subtitle			
Cellcykelsimulering (Cell cycle simulation)			
Abstract			
<p>The growth of a population of cells can in some cases be expressed by a couple of more or less complicated differential equations. For the most, these have to be solved numerically, which means that you have to work with difference equations instead. A more direct way is to create a model in some computer language and simulate the cell culture growth. A flow system model in Fortran has been developed as an alternative to a Monte Carlo model, and these two models are described and compared with each other. The influence of characteristic cell parameters and of the choice of sample interval is examined, and the difference between the two models in simulation time and flexibility is also discussed. Three simulations have been done with both of the models:</p> <ol style="list-style-type: none"> <li>1. Simulation with free exponential growth</li> <li>2. Simulation with growth and a single radiation dose</li> <li>3. Simulation with growth and weekly radiation in 4 weeks.</li> </ol>			
Key words			
Classification system and/or index terms (if any)			
Supplementary bibliographical information			
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Swedish	60		
Security classification			

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<b>LUND INSTITUTE OF TECHNOLOGY</b> DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name	
		Master Thesis	
		Date of issue	
Author(s) Bengt Levin		March 1981	
		Document number	
		LUTFD2/(TFRT-5244)/1-039/(1981)	
		Supervisor	
		Lars Pernebo	
		Sponsoring organization	
Title and subtitle Eliminering av störningar vid försegling med ultraljud (Elimination of disturbances at sealing with ultrasound)			
Abstract <p>Packages made of plastics may be welded by ultrasonic. An electrical signal with high energy is converted in a piezoelectrical crystal to a mechanical vibration. If this motion is transmitted to the plastic, it will generate heat. When heating the plastic it melts and two pieces can be welded together. The amount of heat transferred is proportional to the welding time. To get a proper joint the welding time should not be too short neither too long. In this case the joint will be rigid and fragile.</p> <p>Due to influence of disturbances (changes in line voltage, pneumatic pressure etc), the quality of the joint changes of a constant welding time is used. The influence will be eliminated if the supplied energy is measured and the welding is terminated when a certain amount of energy is transferred to the joint.</p> <p>A design has been done in accordance with the princip mentioned above and the thesis has been proved.</p>			
Key words			
Classification system and/or index terms (if any)			
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Swedish	39		
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<b>LUND INSTITUTE OF TECHNOLOGY</b> DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7      Sweden		Document name Master thesis	
		Date of issue March 1981	
		Document number CODEN: LUTFD2/(TFRT-5245)/1-86/(1981)	
Author(s) Anders Helmersson		Supervisor Karl Johan Åström	
		Sponsoring organization	
Title and subtitle DUAL REGLERING - En optimal dual regulator för en integrator med konstant men okänd förstärkning. (DUAL CONTROL - An optimal dual regulator for an integrator plant with constant but unknown gain)			
Abstract Nonlinear stochastic control theory is applied to a simple discrete integrator with unknown gain. The optimal dual control algorithm is evaluated numerically and interpreted intuitively. Some numerical problems arised are discussed. Using simulated examples, a comparison is made of the performance of some previously suggested suboptimal regulators, and the optimal one.			
Key words			
Classification system and/or index terms (if any)			
Supplementary bibliographical information			
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## LUND INSTITUTE OF TECHNOLOGY

DEPARTMENT OF AUTOMATIC CONTROL

Box 725

S 220 07 Lund 7 Sweden

Document name

MASTER THESIS

Date of issue

APRIL 1981

Document number

CODEN:LUTFD2/(TFRT-5246)/O-045/(1981)

Author(s)

Henriette Weibull

Supervisor

J Wieslander and B Wittenmark

Sponsoring organization

Title and subtitle

Some Programs for Frequency Analysis in IDPAC.

Abstract

This report deals with a part of the program package IDPAC that concerns frequency analysis. The outlines of the commands ASPEC, BODE, CSPEC, FROP, and SPTRF, which are implemented in IDPAC are given. The command OPTIM, designed to give an optimized transfer function from an input frequency response, is described.

Key words

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<b>LUND INSTITUTE OF TECHNOLOGY</b> DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name	
		Master thesis	
		Date of issue	
Author(s)  Jan-Åke Månsson Sten-Åke Bergman		April 1981	
		Document number	
		CODEN: LUTFD2/(TFRT-5247)/1-080/(1981)	
		Supervisor	
		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle Simulering av fjärrvärmenät (Simulation of a district heating system)			
Abstract <p>In this work we build up a simple mathematical model of a district heating system. The model consists of three parts: Distributing pipe, pump, and user area.</p> <p>To test the validity of the models we have done an adaption to a real district heating net (Gävle). After the adaption an investigation is made to look how the costs depend on the forward temperature with constant load (constant out-temperature).</p>			
Key words			
Classification system and/or index terms (if any)			
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Swedish	80		
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