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MASTER THESES IN AUTOMATIC CONTROL 1980/81

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NOVEMBER 1981

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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.

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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 seaking regulators). August 1980.

TFRT-5237 CHARLOTTE STALIN: Elektrohydrauliskt Bromssystem (Electro-hydraulic breaking 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 systemdynamik 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

Subject	Thesis
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
LUND INSTITUTE OF TECHNOLOGY
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-5236)/1-044/(1980)

Author(s)
Ingvar Bäckestrand

Sponsoring organization

Title and subtitle
Extremalsökande regulatorer
(Extremal seaking regulators)

A4 A5

Abstract

Three discrete time algorithms for extremum control 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 perturbation and stepping methods. A slight modification of the stepping method shows great similarities with a simple form of the self-driving method 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.

Key words

A4 A5

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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)

A4 A5

Abstract

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.

The aim of this work was to calculate and simulate the transfer-fuction for a system of this type.

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.

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.

Key words

A4 A5

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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)

A4 A5

Abstract

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.

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.

Key words

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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
A4 A5

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.

Key words
A4 A5

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Document name
MASTER THESIS

Date of issue
August 1980

CODEN: LUTFD2/(TFRT-5240)/1-027/(1980)

Author(s)
Anders Hellaeus

Sponsoring organization Supervisor:
Björn Wittenmark

Title and subtitle
Experiment med självinställande PID-regulator
(Experiment with self-tuning PID-controller)

A4 A5

Abstract
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.

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.

Key words

A4 A5

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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)

A4 A5

Abstract

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 improvments which are not yet tested, have also been given.

Key words

A4 A5

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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

A4 A5

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.

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.

Key words

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Date of issue
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CODEN: LUTFD2/(TFRT-5243)/1-055/(1981)

Author(s)
Göran Oleskog

Supervisor
Per Hagander

Sponsoring organization

Title and subtitle

Cellcykelsimulering (Cell cycle simulation)

Abstract

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:

1. Simulation with free exponential growth
2. Simulation with growth and a single radiation dose
3. Simulation with growth and weekly radiation in 4 weeks.

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March 1981

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LUTFD2/(TFRT-5244)/1-039/(1981)

Author(s)
Bengt Levin

Supervisor
Lars Pernebo

Sponsoring organization

Title and subtitle

Eliminering av störningar vid försegling med ultraljud
(Elimination of disturbances at sealing with ultrasound)

Abstract

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.

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.

A design has been done in accordance with the princip mentioned above and the thesis has been proved.

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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

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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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Author(s)
Jan-Åke Månsson
Sten-Åke Bergman

Supervisor
Björn Wittenmark

Sponsoring organization

Title and subtitle

Simulering av fjärrvärmenät (Simulation of a district heating system)

Abstract

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.

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).

Key words

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