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CODEN: LUTFD2/(TFRT-6014)/1-028/(1984)

MASTER THESES IN AUTOMATIC CONTROL 82/83

BJÖRN WITTENMARK

DEPARTMENT OF AUTOMATIC CONTROL
LUND INSTITUTE OF TECHNOLOGY

JANUARY 1984

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Author(s) Björn Wittenmark		Document number	
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Master Theses in Automatic Control 82/83			
Abstract			
The report contains abstracts of Master Theses (examensarbete) made of the Department of Automatic Control, Lund, during the academic year 82/83. During this year 23 theses were made by 25 students. Most of the theses are written in Swedish with an English abstract.			
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MASTER THESES IN AUTOMATIC CONTROL 82/83

B. Wittenmark

Department of Automatic Control
Lund Institute of Technology
Lund, Sweden

Abstract The report contains abstracts of Master Theses (examensarbeten) made at the Department of Automatic Control, Lund, during the academic year 82/83. During this year 23 theses were made by 25 students. Most of the theses are written in Swedish with an English abstract.

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 month of full time work. The thesis can be made individually or by two students together.

This report is a collection of the document pages of the theses completed during the academic year 1982/1983. During this time 23 theses were finished by 25 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 in cooperation with the industry or other departments at the university.

Further information concerning the results can be obtained from the Department of Automatic Control by contacting the advisor. The theses may be borrowed through your library service or from the following libraries in Sweden:

Linköpings Universitetsbibliotek
Svensktrycket, S-581 83 Linköping, Sweden

UB 2, Svenska Tryckavdeln.
Box 1010, S-221 03 Lund, Sweden

Stockholms Universitetsbibliotek
Svenska Tryckavdeln., S-106 91 Stockholm, Sweden

Kungliga Biblioteket
Box 5039, S-102 41 Stockholm, Sweden

Umeå Universitetsbibliotek
Box 718, S-901 10 Umeå, Sweden

Uppsala Universitetsbibliotek
Box 510, S-751 20 Uppsala, Sweden

2. LIST OF THESES

- TFRT-5278 Henriksson J: PI-algoritmer vid digital reglering. (Digital algorithms for PI-control). Aug 1982.
- TFRT-5279 Fohlin G: Mätvärdesinsamling med mikrodator utförd på en margarinprocess. (Microcomputerbased data collection system for a margarin process). Aug 1982.
- TFRT-5280 Rignell M: Tre dimensionell datorgrafik och animering av industrirobot. (Three dimensional computer graphics and animation of an industrial robot). Sept 1982.
- TFRT-5281 Jönsson H-A, Svensson K: Styrning av fiberutläggning. (Control of fiberdistribution in insulation material). Aug 1982.
- TFRT-5282 Andersson F, Lindh G: Självinställare baserade på gradientmetoder. (Self-tuning regulator based on gradient methods). Sept 1982.
- TFRT-5283 Palmgren M: En självinställande PID-regulator för system med variabel tidsfördröjning. (A self-tuning PID-regulator for systems with variable time delay). Sept 1982.
- TFRT-5284 Hansson L: Studier av syre-reglering i biologisk avloppsrening. (Studies of Dissolved Oxygen Control in Biological Wastewater Treatment). Sept 1982.
- TFRT-5285 Svensson P-E: Experiment med en linjär-kvadratisk självinställare. (Experiments with a linear-quadratic selftuner). Sept 1982.

- TFRT-5286 Lund M: Neutronflödesystem med SPN-detektorer. Kompensering för neutronaktiveringseffekter med datoriserad signalbehandling. (Neutron flux monitoring system based on SPN-detectors. Compensation for effects due to neutronactivation by computerized signal processing). Oct 1982.
- TFRT-5287 Andersson K: Uppbyggnad av en digital bildhantering i ett svepelektronmikroskop. (Subroutines for taking up and displaying pictures from a computer controlled scanningelectronmicroscope. Oct 1982.
- TFRT-5288 Kai Siew W: Methods for Automatic Tuning of PID Regulators. Dec 1982.
- TFRT-5289 Glver S: Modell och styrning av tvåmotorprocess med kopplade likströmsmotorer. (Model and control of process with coupled DC-motors). Sept 1983.
- TFRT-5290 Delacour O: Elektroniska bromssystem - en lämplighetstest. (Electronic airbrake systems - A feasibility study). Febr 1983.
- TFRT-5291 Möllerström A: Referat av handbok för TA 6500 mikrodatorbaserad reglerenhet. Undersökning av några olika inställningsregler för PI-regulatorer. (Handbook for TA 6500 microprocessor control unit and investigation of some tuning rules for PI-controllers). March 1983.
- TFRT-5292 Nilsson K: Analys och syntes av en industrirobots dynamik. (Analysis and synthesis of the dynamics of an industrial robot). March 1983.
- TFRT-5293 Hansson L G: En självinställande regulator för frekvensreglering av kraftsystem med högspänd likström. (A self-tuning regulator for frequency control of power systems with high voltage direct current). March 1983.

- TFRT-5294 Tocaş R: Ellipsoidmetoden: Khachijans Algoritm för linjär programmering. (The Ellipsoid method: Khachijans algorithm for linear programming). April 1983.
- TFRT-5295 Rasmusson U: Simulering av dynamiken i en kokarreaktor. (Simulation of boiling water reactor dynamics). April 1983.
- TFRT-5296 Persson P: Simulering och feldetektering i ett ventilservo för tryckreglering av en kokarreaktor. (Simulation and fault-detection of a pressure control servosystem in a Boiling Water Reactor). April 1983.
- TFRT-5297 Salmi M: Temperaturreglering av torkprocess med digital regulator. (Temperature control of dryingprocess with a digital controller). May 1983.
- TFRT-5298 Olsson J: Reglerad peroxidmiljö i en mikrobiell process. (Controlled peroxidlevel in a microbial process). May 1983.
- TFRT-5299 Wingertz B: Practical Aspects on Self Tuning Regulators. May 1983.
- TFRT-5300 Falkvall K: LQG-regulator för flygplan. (LQG-controller for an aircraft). June 1983.

3. LIST OF SUBJECTS

<u>Subject</u>	<u>Thesis</u>
Adaptive control	5882, 5283, 5285, 5288, 5293, 5299
Analysis and synthesis	5281, 5289, 5290, 5295, 5296, 5300
Biological systems	5284, 5298
Computer graphics	5280, 5292
Data handling and Identification	5279, 5286
Digital control	5278, 5291, 5297
Modelling and Identification	5292, 5295, 5296
Numerical analysis	5294
Robotics	5280, 5292

4. DOCUMENT PAGES

The following pages contain the document pages of the theses. Most of the theses are written in Swedish with only an abstract in English.

LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name		
		Report		
		Date of issue		
		August 1982		
Author(s)	Jan Henriksson	Document number		
		CODEN: LUTFD2/(TFRT-5278)/1-057/(1982)		
		Supervisor		
		D Renborg, J Ancker, B Wittenmark		
		Sponsoring organization		
Title and subtitle				
Digital algorithms for PI-control				
(PI-algoritmer vid digital reglering)				
Abstract				
In this report a theoretical and an experimental investigation is made of different types of PI-algorithms in digital control. Four different ways to translate transfer functions from the Laplace- and to the Z-transform are investigated. Six different programs for PI-controllers are presented, and are tested with different sample times and constants. The comparison is made for different types of transfer functions. Setting time, overshoots, static errors and "reset windups" are compared.				
Key words				
Classification system and/or index terms (if any)				
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		Report			
		Date of issue			
		August 1982			
Author(s) Gerth Fohlin	Document number				
	LUTFD2/(TFRT-5279)/1-087/(1982)				
	Supervisor				
		Lars Pernebo, Björn Wittenmark			
		Sponsoring organization			
Title and subtitle					
Microcomputerbased data collection system for a margarine process (Mätvärdesinsamling med mikrodator utförd på en margarinprocess)					
Abstract					
Following report describes a computerized measuringsystem based on the swedish micro-computer ABC 80. The system was able to handle up to 30 measuring channels. Received measuring data was stored on a discett. The control of the system was carried out by a program in the computer. For analysis of the result, a few program was developed. The system was applicated on a margarinemaking process and found out to have the desirable function.					
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			
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S 220 07 Lund 7 Sweden

Document name
Report

Date of issue
September 1982

Document number
LUTFD2/(TFRT-5280)/1-067/(1982)

Author(s)

Mikael Rignell

Supervisor

Hilding Elmqvist

Sponsoring organization

Title and subtitle

Three dimensionel computer graphics and animation of an industrial robot
(Tre dimensionell datorgrafik och animering av industrirobot.)

Abstract

A three dimensionel graphics package has been developed. It enclues scan conversion of polyqous, hidden surface removal, shading and transformation of coordinate systems. It has been used for animation of an industrial robot. The movement of the robot is specified in a cartesian coordinate system using jousticks.

Key words

Computer graphics, robotics

Classification system and/or index terms (if any)

Supplementary bibliographical information

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Document name

Report

Date of issue

August 1982

Document number

CODEN:LUTFD2/(TFRT-5281)/1-078/(1982)

Author(s)

Hans-Åke Jönsson

Kjell Svensson

Supervisor

Björn Wittenmark

Sponsoring organization

Title and subtitle

Control of variation in density of a fiberglasscarpet.

(Styrning av fiberutläggning)

Abstract

The subject of this master thesis was originally proposed by the fiberglasscompany Gullfiber in Billesholm. The purpose of the assignment was to find methods to decrease and control the variation in density of a fiberglass insulating carpet. After a brief description of the process and the conditions for the further work we then compute the ideal frequency in relationship to the velocity of the receiving line. We then explain the measurements done to confirm the theory. With frequencyanalysis we can show that the wig-wag frequency is not very strong as distinct as frequencies of densityvariation. Instead the variation is more LF. Therefor we found a more probable cause for the variations in preasure-variation.

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LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name			
		Report			
		Date of issue			
		September 1982			
Author(s) Fred Andersson Göran Lindh	Document number				
	CODEN:LUTFD2/(TFRT-5282)/1-052/(1982)				
	Supervisor				
		Björn Wittenmark			
		Sponsoring organization			
Title and subtitle Self-tuners based on gradient methods (Självinställare baserade på gradientmetoder)					
Abstract The report presents a scheme for self-tuning regulators based on gradient methods. The feasibility of the scheme is studied in some special cases. The scheme is used together with different estimation techniques such as extended least squares (ELS) method and indirect estimation using a one to one correspondance with the regulator parameters. The method is illustrated using simulations of two different processes.					
Key words					
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LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name			
		Report			
		Date of issue			
		September 1982			
Author(s) Martin Palmgren	Document number				
	CODEN:LUTFD2/(TFRT-5283)/1-058/(1982)				
	Supervisor				
		Björn Wittenmark			
		Sponsoring organization			
Title and subtitle A Selftuning PID-Controller For Systems with Timevarying Timedelay (En självinställande Pid-regulator för system med variabel tidsfördröjning)					
Abstract A selftuning PID-controller is investigated. It is assumed that the process order is two. A pole-placement-algorithm is used to get the desired closed loop poles. Two methods is studied for the calculation of the controlparameters. The first method is based on solving a system of equations. The second method makes a two-steps-estimation of the controlparameters. The only $\hat{a}$ -priori knowledge of the process needed is, except the order, the maximum timedelay. The two methods are compared using simulated systems. It is shown that the discussed controller can adapt to changes in the timedelay.					
Key words					
Classification system and/or index terms (if any)					
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LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden		Document name	
		Report	
		Date of issue September 1982	
Author(s) Lennart Hansson	Document number CODEN:LUTFD2/(TFRT-5284)/1-053/(1982)		
	Supervisor Gustaf Olsson		
	Sponsoring organization		
Title and subtitle Studies of Dissolved Oxygen Control in Biological Wastewater Treatment (Studier av syre-reglering i biologisk avloppsrening)			
Abstract In this report, the dynamics of an aertor of an activated sludge process is studied. Two control strategies for the dissolved oxygen concentration are tested. One contains either a PI-controller or a on-off controller, the other a self-tuning controller. There are two key-parameters in the system, $K_L a$, the total oxygen transfer rate, and OUR, the oxygen uptake rate of the microorganisms in the aerator. The parameters are difficult to obtain from direct measurements. An estimator is derived. The estimates will be calculated from the process output, DO-concentration, and from the input signal, the air-flow rate. The estimator is also part of a self-tuning controller. Here, the controller works with a minimum variance algorithm. The simulations show, that the estimates contain a bias, if the estimation of the two parameters are done at the same time. Different methods are tested to avoid this problem. Even if bies cannot be avoided, the estimator can be used in a self-tuning controller because the <u>total</u> estimation error is close to zero. To obtain unbiased estimates of the two parameters is important in other aerator control schemes. Therefore different approaches have to be taken. The simulations show that an acceptable control can be obtained both with a PI-controller and with a self-tuning controller.			
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		CODEN:LUTFD2/(TFRT-5285)/1-065/(1982)	
		Supervisor	
Per-Erik Svensson		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle			
Experiment med en linjär-kvadratisk självinställare			
(Experiments with a linear-quadratic selftuner)			
Abstract			
This report describes a program for a linear-quadratic selftuner. It also includes results from experiments with the regulator. In the experiments different processes has been simulated on an analog computer. An important result from the experiments is that if an antialiasfilter is used when regulating a process, the dynamics of the the filter must be included in the processmodel. It is also necessary to take into account the time-delay in the regulator when using short samlingperiods.			
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DEPARTMENT OF AUTOMATIC CONTROL

Box 725

S 220 07 Lund 7 Sweden

Document name

Report

Date of issue

Oktober 1982

Document number

CODEN:LUTFD2/(TFRT-5286)/1-077/(1982)

Author(s)

Michael Lundh

Supervisor

Sponsoring organization

Title and subtitle

NEUTRONFLÖDESMÄTSYSTEM MED SPN-DETEKTORER. Kompensering för neutronaktiveringseffekter med datoriserad signalbehandling. (NEUTRON FLUX MONITORING SYSTEM BASED ON SPN-DETECTORS. Compensation for effects due to neutronactivation by computerized signal

Abstract

/ processing)

A system for neutronflux monitoring is under development. It is based on Self-powered neutront detectors with cobaltemitter. The characteristic of this type of detector change, due to irradiation, and must be compensated for. A model based on the two domination components in the detectorcurrent has been developed. One component is proportional to thermal neutronflux and the quantity of the isotope ⁵⁹Co in the emitter. The other is a not wanted background current caused by the beta-decaying isotope ⁶⁰Co. To be able to make a correct compensation of the detectorchanges it is necessary to estimate the isotopequantities in the emitter. This is done by the computer in the system. The here described program calculates the new isotope-quantities every twenty hour and has the capacity to administrate forty Self-Powered neutront detectors.

Key words

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		Report	
		Date of issue October 1982	
		Document number CODEN:LUTFD2/(TFRT-5287)/O-44/(1982)	
Author(s) Kaj Andersson		Supervisor Björn Wittenmark	
		Sponsoring organization	
Title and subtitle Uppbyggnad av en digital bilhantering i ett svepelektronmikroskop. (Subroutines for taking up and displaying pictures from a computer controlled scanning-electronmicroscope (SEM)).			
Abstract The programs are made to decide testingpoints in an integrated circuit. The measurements on the IC are performed in a SEM using digital electronbeamdeflection and digital secondary-electrondetection. A PDP11/23 computer and a QRGB-256 video-interface are used. Programs are written in MACRO-assembler and FORTRAN. Pictures may be taken up and stored on a massstorage (floppy-disk) for later retrieval. The picture image may be changed (color and displayingarea). Co-ordinates in the displayed pictures may be estimated with a joystickmovable cross. Also the picturearea may be moved with the joystick.			
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		REPORT	
		Date of issue	
		Dec 1982	
Author(s) Kai Siew,Wong		Document number	
		CODEN:LUTFD2/(TFRT-5288)/1-080/(1982)	
		Supervisor	
		Tore Hägglund	
		Sponsoring organization	
Title and subtitle			
Methods for automatic tuning of PID regulators			
Abstract			
A self-tuning PID-regulator has been investigated. The design method is based on the very well-known and simple Ziegler-Nichols self oscillation method. By introducing the describing function technique and by connecting a relay in the closed loop system, an oscillation is obtained automatically. It is noticed that this oscillation, whose amplitude is depending on the amplitude of the relay, has the same characteristics as the one, which is obtained manually by the Ziegler-Nichols self oscillation method, i.e. only proportional regulator is used and the oscillation is then obtained by increasing the gain gradually. Two methods, namely the peaks and zero-crossings method and the recursive least squares method, are proposed for estimating the amplitude and the frequency of the oscillation, in order to determine the critical gain and the ultimate period. The settings of the PID-regulator are then determined according to the tuning rules. The investigations have carried out first without any disturbance with four processes, and then only one of the four processes with measurement noise and load disturbance. Different levels of the measurement noise are used. A relay with hysteresis is used in order to make those methods for estimating the parameters less sensitive to the measurement noise. The problems of high frequency point of convergence and the level adjustment of the control signal have also been investigated. The results have shown that there is an advantage of using the relay with hysteresis and the self-tuner works quite well as a whole.			
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		September 83	
Author(s)	Sören Giver	Document number	
		CODEN:LUTFD/(TFRT-5289)/(1-051)/(1983)	
		Supervisor	
		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle			
Modell och styrning av tvåmotorprocess med kopplade likströmsmotorer. (Model and control of process with coupled DC-motors.)			
Abstract			
The goal of this work is to build a dynamic model for a scalemodel of a process with coupled drives, using frequency and step-response analysis and to construct a regulator for this model. The scale-model, constructed by the English company Tecquipment, is primarily intended for laboratory use by students. The main problem is to reduce the interaction between the dynamics of the tension and the dynamics of the speed in the material which is transported between the DC-motors. This is solved by introducing a decoupling device in the regulator which makes it possible to control speed and tension with two independant control signals. A model based on physical laws has been constructed and simulations have shown satisfactory resemblances to the real system.			
Key words			
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		Date of issue February 1983	
		Document number CODEN:LUTFD2/(TFRT-5290)/0-081/(1983)	
Author(s) Olivier Delacour		Supervisor G.Olsson, LTH, S. Stomrud, SAB och K.Edvardsson, SAB	
		Sponsoring organization	
Title and subtitle Electronic Airbrake Systems - A Feasibility study. Elektroniska bromssystem - en lämplighetstest			
Abstract During recent years, the application of electronic devices to road vehicles has grown tremendously. Increased environmental concern and requirements on fuel economy, comfort and safety have created a need for compact and advanced micro-computer technology. A vehicle is a problematic environment for electronic devices due to dust, damp, vibrations, noise and glitches. This report first gives an overview of electronic applications on road vehicles and concentrates later on truck and bus airbrake systems. Dynamic problems like delay, wheel lockning and load compensation are discussed. A model of a feed back brake system that compensates for some of the delay and that can be combined with a load compensating and anti-skid system is derived and simulated.			
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		CODEN:LUTFD2/(TFRT-5291)/0-040/(1983)	
		Supervisor	
		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle			
Handbook for TA 6500 microprocessor control unit and investigation of some tuning rules for PI-controllers.			
Abstract			
This work contains two independent parts.			
The first part is mainly a report on a documentation of a microprocessed control device called TA 6500, manufactured by Tour & Anderson AB.			
The other part contains a documentation of an investigation concerning different adjustment rules for PI-controllers.			
Key words			
Classification system and/or index terms (if any)			
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ISSN and key title		ISBN	
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		Report	
		Date of issue	
		March 1983	
Author(s)	Klas Nilsson	Document number	
		CODEN: LUTFD2/(TFRT-5292)/0-079/(1983)	
		Supervisor	
		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle			
Analysis and synteis of the dynamics of an industrial robot. (Analys och syntes av en Industrirobots dynamik)			
Abstract			
Frequency analysis of the mechanical part of an ASEA industrial robot is performed. For the axis that limits the performance, the poles and zeros are calculated by means of curve fitting. An approach is made to design a speed regulator using polynomial synthesis. Due to the very high sensitivity of modelling errors the conclusion is that it is uncertain if the required rize time of 15-20 ms can be reached by using theoris for sampled systems.			
Key words			
Classification system and/or index terms (if any)			
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Author(s)		Document number	
		CODEN:LUTFD2/(TFRT-5293)/0-138/(1983)	
		Supervisor	
Leif-Göran Hansson		Björn Wittenmark	
		Sponsoring organization	
Title and subtitle			
En självinställande regulator för frekvensreglering av kraftsystem med högspänd likström. (A self-tuning regulator for frequency control of power systems with high voltage direct current.)			
Abstract			
A self-tuning controller for frequency control of power systems by HVDC. One of the advantages of High Voltage Direct Current, HVDC, is the possibility to control the powerflow between different parts of an A.C. network. This property is being used when disturbances in the frequency, caused by load variations, is eliminated. Simulation studies on a physically scaled model of the "Gotland-transmission" has been done. Also a model of frequency oscillations between two connected power-areas is simulated on an analog computer. The controller is based on the criterion to minimize the variance of the frequency deviation combined with the recursive method of least squares.			
Key words			
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Author(s)	Ronny Tocaj	Document number		
		CODEN:LUTFD2/(TFRT-5294)/O-061/(1983)		
		Supervisor		
		Per Olof Gutman		
		Sponsoring organization		
Title and subtitle Ellipsoidmetoden: Khachijans Algoritm för Linjär Programmering. (The Ellipsoid method:Khachijans Algorithm for Linear Programming)				
Abstract This thesis treats the ellipsoid method for linear programming. The method is described both from a theoretical and a practical point of view. A subroutine, LPEM, which solves LP-problems with the ellipsoid method, is presented and described. LPEM is written in Pascal. Finally some computational results from running LPEM on two testexampels, Klee-Minty's problem and the double integrator controlled by the LP-regulator, are presented and discussed.				
Key words The ellipsoid method, Khachihihan's algorithm, Linear programming.				
Classification system and/or index terms (if any)				
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Author(s)	Ulf Rasmusson	Document number		
		CODEN:LUTFD2/(TFRT-5295)/1-44/(1983)		
		Supervisor		
		Sten Bergman		
		Sponsoring organization		
Title and subtitle				
(Simulering av dynamiken i en kokarreaktor.) Simulation of Boiling Water Reactor dynamics.				
Abstract				
This master thesis describes a mathematical model of a boiling water reactor and address the dynamic behaviour of the neutron kinetics, boilding dynamics and pressure stability. The simulations have been done using the SIMNON-program. The meaning were that the result from this work possibly would be adjust to supervision methods suitable for application in computer systems. This master thesis in automatic control has been done at the Department of Automatic Control, Lund Institute of Technology. The initiative to the work came from Sydkraft AB. At the realization of the work, civ.ing. Sten Bergman, Sydkraft AB has been the instructor.				
Key words				
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		Report	
		Date of issue April 1983	
Author(s) Per Persson		Document number CODEN:LUTFD2/(TFRT-5296)/1-93/(1983)	
		Supervisor Sten Bergman	
		Sponsoring organization	
Title and subtitle (Simulering och feldetektering i ett ventilservo för tryckreglering av en kokarreaktor.) Simulation and fault-detection of a pressure control servosystem in a Boiling Water Reactor.			
Abstract This master thesis describes a Simnon model of a boiling water reactor to be used in simulating faults and disturbances. These faults and disturbances will be detected by noise analysis. Some methods in identification and noise analysis are also described and are applied on some malfunctions of a servo. A Pascal program for recursive parameter identification was also written and tested. This program is to be used in an expert system for noise analysis on the nuclear power plant Barsebäck.			
Key words			
Classification system and/or index terms (if any)			
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		Date of issue May 1983	
		Document number CODEN:LUTFD2/(TFRT-5297)/1-54/(1983)	
Author(s) Mikael Salmi		Supervisor Carl Mannerfeldt, Matz Lenells	
		Sponsoring organization	
Title and subtitle Temperature Control of Dryingprocess with a Digital Controller. (Temperaturreglering av torkprocess med digital regulator.)			
Abstract In this report, the dynamics of a <u>drying drum</u> in a <u>fertilizer</u> industry have been studied, and a digital temperature controller have been designed. A number of step responses were measured, to get an idea on how the process worked. From the step responses the conclusion were drawn that a cascads-controller, feed-backed from both the temperature into and out from the drying drum, would control the temperature sufficiently. To find the best parameter values two different strategies were used: the first one is to optimize the step response of the temperature and the other one is to simulate a physical model of the drying drum with a simulation-program. For both the strategies a sampling-interval of one minute were used. The program was implemented in the computer and the controller were tested on the real process. The parameter values were adjusted and the final result was: $K_p = 0.3$, $K_{pi} = 31 \text{ l/}^\circ\text{C}$, $T_i = 8.5 \text{ minutes}$. Although the simulation were made with a rough physical model, its parameter values were much closer to the final ones than the values from the optimization. This shows that one can get good results even with a simple model. However, it is not always that easy to put up a physical model. In the last chapter the control system has been examined. The meaning is to show how a working system in industry can look like, and to show how the actual control design is put into the computer.			
Key words			
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Report

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Author(s)

Jonny Olsson

Supervisor

Per Hagander, Olle Holst

Sponsoring organization

Title and subtitle

Controlled peroxidelevel in a microbial process.

(Reglerad peroxidmiljö i en mikrobiell process.)

Abstract

Consumption of oxygen in microbial processes is often rapid and in dense cultures the supply of oxygen might be limiting. Conventional aeration, e.g. agitation, is not possible when using immobilized cells due to the low mechanical stability of the preparations. The acetic acid bacteria Gluconobacter oxydans catalyses the conversion of glycerol to dihydroxyacetone and the decomposition of hydrogen peroxide to oxygen. Oxygen is necessary for the first conversion and consequently hydrogen peroxide might be used as an oxygen source in a process for production of dihydroxyacetone.

However, hydrogen peroxide is toxic to microorganisms and thus a controller addition based on measured peroxide-concentration is necessary. A PI-controller and a controller using a Kalman filter are tested on the process. Reaction rate and viability tests gives information about the cell functions. Two different processes have been investigated, one utilizing immobilized cells and one system with membrane reactors.

Key words

Microbial process, Gluconobacter oxydans, Dihydroxyacetone, Hydrogen peroxide, PI-controller, Kalman filter, Immobilized cells.

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		Document number CODEN:LUTFD2/(TFRT-5299)/O-031/(1983)	
Author(s) Bo Wingertz		Supervisor Karl Johan Åström	
		Sponsoring organization	
Title and subtitle "Practical Aspects on Self Tuning Regulators" (Praktiska aspekter på självinställande regulatorer)			
Abstract Self Tuning Regulators are regarded from a practical point of view. Different problems and some of the solutions to the problems are discussed based on experiences from laboratory experiments. Praktiska aspekter på självinställande regulatorer behandlas. Olika problem och en del förslag till lösningar av dem diskuteras med utgångspunkt från försök med en labprocess.			
Key words			
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