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Master Theses in Automatic Control

Björn Wittenmark

Department of Automatic Control Lund Institute of Technology December 1985

Department of Automatic Control Lund Institute of Technology P.O. Box 118 S-221 00 Lund Sweden	Document name MASTER THESES REPORT Date of issue December 1985 Document Number CODEN: LUTFD2/(TFRT-6016)/1-021/(1985)
Author(s) B. Wittenmark	Supervisor Sponsoring organisation
Title and subtitle Master theses in Automatic Control 84/85	

The report contains abstracts of Master Theses (examensarbeten) made at the Department of Automatic Control, Lund, during the academic year 84/85. During this year 16 theses were made by 18 students. Most of the theses are written in Swedish with an English abstract.

Key words				
Classification system a	nd/or index terms (if any)			
Supplementary bibliographical information				
ISSN and key title			ISBN	
Language English	Number of pages 21	Recipient's notes		
Security classification				

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.

MASTER THESES IN AUTOMATIC CONTROL 84-85

B. Wittenmark

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 1984/1985. During this time 16 theses were finished by 18 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-5308 Björn Malmström: Dynamisk modellering och simulering av värmecentral med fjärrvärmenät-tillämpning Skurup (Dynamical modelling and simulation of a district heating plant and network in Skurup). July 1984.
- TFRT-5309 Ulf Steen: Simulering och reglering av ett system med en tre-fluids-värmeväxlare (Simulation and regulation of a system including a three-fluid heatexchanger). June 1984.
- TFRT-5310 Jan Eric Larsson: An expert system interface for ldpac. July 1984.
- TFRT-5311 Carl Almquist: Automatisk utvärdering av mätvärden från en hammarkvarnsprocess (Automatic evaluation of measurement values from a hammer mill process). Aug 1984.
- TFRT-5312 Peter Lerup: Ett grafiskt hjälpmedel för programutveckling i Ada (A graphical tool for program development in Ada). Sept 1984.
- TFRT-5313 Anders Jansson: Beräkning av regulatorparametrar med hjälp av i regulatorn inbyggd process modell (Computation of regulator parameters using gain scheduling). Sept 1984.
- TFRT-5314 Kenneth Nilsson: Strukturidentifering av aktivslamprocessen (Structural identification of the Activated sludge process). Nov 1984.
- TFRT-5315 Ulf Persson: Reglering av system med variabel tidsfördröjning (Control of systems with timevarying timedelay). Nov 1984.

- TFRT-5316 Bernt Nilsson: Enzymatisk hydrolys av cellulosa i tvåfas-system (Enzymatic hydrolis of cellulose in two-phase system). Dec 1984.
- TFRT-5317 Magnus Taube: Grafisk presentation och editering av matematiska uttryck och reläschema (Graphic Presentation and editing of mathematical expressions and ladder diagrams). Dec 1984.
- TFRT-5318 Ulf Holmberg: Simulering av aktivslamprocessers dynamik (Simulation of the dynamics of activated sludge systems). Febr 1984.
- TFRT-5319 Magnus Lundblad, Richard Svensson: Simulering av frekvenssyntes (Design and simulation of frequency synthesis). Dec 1984.
- TFRT-5320 Mårten Lindberg: Reglering av aktivslamprocessen vid AKO, Karlshamn. En förstudie (Control of an activated sludge process at AKO, Karlshamn. A feasibility studie). Jan 1985.
- TFRT-5321 Jonas Brånhult: Optimal "fed-batch"-odling av jäst (Optimal fed-batch growth of bakers yeast). May 1985.
- TFRT-5322 Ulf Adamsson: Infrysning av livsmedel simulering av en industriell process (Freezing of foods – simulation of an industrial process). May 1985.
- TFRT-5323 Stefan Nilsson, Tor Sjödin: Autonom reglercentral (Stand alone controller). June 1985.

3. LIST OF SUBJECTS

Subject	<u>Thesis</u>
Adaptive control	5315
Analysis and synthesis	5311, 5323
Biological processes	5316, 5321
Digital control	5317
Expert systems	5310
Modelling and identification	5308, 5309, 5319, 5322
Power systems	5308, 5313
Programming tools	5312
Waste water treatment	5314, 5318, 5320

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 Enlish. \Im

LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725	Document name MASTER THESIS
	Date of issue July 1984
S 220 07 Lund 7 Sweden	Document number CODEN.LUTFD2/(TFRT-5308)/(1-63)/(1984)
Author(s)	Supervisor Björn Wittenmark
Björn Malmström	Sponsoring organization
Title and subtitle Dynamisk modellering och simulering av vär Skurup. (Dynamical modelling and simulatio in Skurup.)	necentral med fjärrvärmenät - tillämpning n of a district heating plant and network
Abstract The thesis analyzes a heating system compr piping system, and buildings, including th cerns a given plant in the town Skurup (in task was to examine the cooperation betwee a basis for improved control system operat	ising a heat pump, auxiliary boilers, i e internal radiator systems. The work con- the southern part of Sweden), where the n the various generating plants to provide ion.
A general discription is first given of th sewage water system (the heat source), hea and the control system.	e various part systems, including: t pump, radiator systems, oil boilers,
From plant measurements the following main	conclusions can be drawn:
- The radiator supply temperature shows a - A propensity to unstable control system	significant deviation from stipulated value, operation is observed
For system parts dynamical models were developed and the performance of the system as a whole was simulated by means of the computer program called SIMNON. As an important result the auxiliary boilers were seen to partly replace the heat pump during start-up periods.	
Key words	
Classification system and/or index terms (if any)	
Supplementary bibliographical information	
ISSN and key title	ISBN
Language Number of pages 63	Recipient's notes
Security classification	

LUND INSTITUTE OF TECHNOLOGY	Document name
LUNU INSTITUTE UP TELHNULUGT	MASTER THESTS
DEPARTMENT OF AUTOMATIC CONTROL	.11INF 1984
S 220.07 Jund 7 Sweden	Document number
S LLO VI Edito I Sweden	CODEN:LUTFD2/(TFRT-5309)/0-064/(1984)
Author(s)	Supervisor
Ulf Steen	Sponsoring organization
*1	
Title and subtitle	
Simulering och reglering av ett system me (Simulation and regulation of a system ind	d en Tre-fluids-värmeväxlare. cluding a Three fluid heatexchanger.)
Abstract	
In this report the equations that describe	es the dynamics of a three-fluid heat-
exchanger and also in a counterflow radia	tor are derived. To be able to simulate
the dynamic wring the simulationlanguage	SIMNON, the equations has been dis-
cretisized The discretized models presen	ted has shown a non-minimum-phase effect
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IO CONTROL AND REGULATE A SYSTEM CONSISTI	ng ot a three-tluid heatexchanger
followed by a radiator, the out-temperatu	re of the radiator's airflow was feedback
with the mass-velocity of the radiator's	waterflow with a PI-regulator. It was shown
that disturbances on the system was quick	ly eliminated with this feedback
chat disturbances on the system was quick	
In this report examples are given how to	further develop and improve the
mathematical models and the regulation of	the system.
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key words	
Classification system and/or index terms (if any)	-
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Supplementary bibliographical information	7
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Language Number of pages	Recipient's notes
Swedish04	
Security classification	

LUND INSTITUTE OF TECHNOLOGY	Decument name	Masters Thesis	
DEPARTMENT OF AUTOMATIC CONTROL Box 725	Onte of issue	July 1984	
\$ 220 07 Lund 7 Sweden	Decument number	ED2//TEPT_5210)/1_04//10	
Author (a)	Supervisor	Karl Johan Aström	
Jan Eric Larsson	Sponsoring ergan	ization	
		11	
Title and subtitle	1		
An Expert System Interface for Idpac			
Abstract		an a	
parts of an expert system: the data bas handling system and the user interfa-	se, the production ace. Some aspe	on rules ects on	
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Box 110 Lund Sweden Indiama number (ITRT - 5311)/1-058/(1984) Author(s) Carl Almquist Sperviser Björn Wittenmark Title and subtitle Sperviser Björn Wittenmark Automatisk utvärdering av mätvärden från en hammarkvarnsprocess (Automatic evaluation of measurment values from a hammer mill process) Abaraer The process in a mill is frequently monitored with the assistance of list of measurment values and alarms from the process. Much time and concentration is sometimes needed to interpret these lists. If the process is described using a model the interpretation can be made automatica by a computer. This would unload the operator and permit the concentration of the operator to be focused on running the process in an economic and energy saving mann The possibilities of creating such a model, describing a hammer mill process, are studied. Different parameters and methods of measurements related to the process. An attempt is made to set up a model to desribe how efficiently the energy is used and the quality of the product. The results is expresses as the coefficient of proc efficiency and is given in percent. The measurement results show very complicated interrelations. They are too few to allow an acceptable model to be set up. In spite of this some conclusions have been made. It seems as if the hammer mill used for the investigations is run unefficently and with great stress. The probabl reasons are brought up and suggestions are made to eliminate the causes. Key words Steemity classification Steemity classification	DEPARTMENT OF AUTOMATIC CONTROL	Date of issue August 1984
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DOKUMENTDATABLAD RT 3/81

LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 725 S 220 07 Lund 7 Sweden	Document name		
	Master Thesis		
	September		
	Document number		
Authoris)		CODEN: LUTFD2/(TFRT-	5312)/1-144/(1984)
Peter Lerup		Hilding Flmgvist	
		Sponsoring organization	
Title and subtitle			
Ett grafiskt hjälpr	nedel för programutved	ckling i Ada.	
(A graphical tool fo	or program development	t in Ada.)	
Abstract			
Nowadays abstractio	on, information hiding	and modularization a	wo woll known
concents which can	be used as teels when		
	be used as tools wher	i creating large, comp	lex software
systems. Ada is a p	programming language w	which makes good use o	f these concepts.
A system has been o	developed which, by us	ing computer animation	n. creates a
"programming space	for an Ada program	A uson of the system :	in chlate mana
around within this	or an Ada program.	A user of the system	is able to move
around within this	space consisting of h	nis own Ada program, ar	nd place himself
at its different mo	odules. Within each mo	dule one of the differ	rent levels of
abstraction can be	selected and this lev	el can be studied or d	hanged Further-
more the user is at	le when in a module	to zoom doum to outward	
hiomomobical laws	, ic, when it a mouure,		odules on a lower
nierarchical level.	1		
All this makes it e	asier to obtain an ov	erview of a complex sy	/stem and facili-
tates the use of mo	dularization, informa	tion hiding and abstra	action.
The system can be r	ogandod ac a prototur		•
ine system can be r	egarded as a prototyp	e of a software develo	oping system for
Ada intended to be	Ada intended to be used on scientific personal computers.		
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LUND INSTITUTE OF TECHNOLOGY	Master thesis		
DEPARTMENT OF AUTOMATIC CONTROL	Date of issue		
Box 725	September		
S 220 07 Lund 7 Sweden	CODEN+111TED2//TERT_5313)/1_047//1984)		
Author (s)			
Anders Jansson	Björn Wittenmark		
	Sponsoring organization		
Beräkning av regulatorparametrar med hjäl (Computation of regulator parameters usir	p av i regulatorn inbyggd process modell. g gain scheduling.)		
Abstract			
This master thesis describes a way to cor model of the controlled process, making i ance over the whole working-area. This re	struct a controller with a built-in t possible to increase the perform- sulted in a gain-scheduled controler.		
The approach has been applied to the cont is a nonlinear and non-minimum phase proc	rol of a hydro-power station, which ess.		
The aim was to improve the performance of from the connected grid.	frequency control, on disturbances		
This resulted in a built-in linear model the working point of the hydro power proc	whose process variables change with ess.		
Controller parameters are computed from t control of the non-linear process.	Controller parameters are computed from this linear model and used for the control of the non-linear process.		
Simulations for the comparison between the hydro power system with a con- ventional controller e.g. PID with fixed parameters, and the described con- troller have been made.			
 This master thesis has been done at the [longestmont of Automatic Control		
Lund Institute of Technology.	epartment of Automatic Control,		
Inititator was ASEA Otkus, Lund.			
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LUND INSTITUTE OF TECHNOLOGY	Document name Master thesis	
DEPARTMENT OF AUTOMATIC CONTROL Box 725	Date of issue November	
S 220 07 Lund 7 Sweden	Document number CODEN:LUTFD2/(TFRT-5314)/1+052/(1984)	
Author(s)	Supervisor Gustaf Olsson	
Kenneth Nilsson	Sponsoring organization	
Title and subtitle		
(Structural Identification of the Activat	en. ed Sludge Process.)	
Abstract		
studied, using real measurements. The act reactor in a wastewater treatment plant. parameters, which makes it awkward to sim same time. For that reason the model is d	ual model parameters are ual model describes the biological The model contains many unknown ulate and adapt all of them at the ivided into smaller parts.	
First the differential equation of dissolved oxygen has been studied. The dissolved oxygen model is simulated using two input signals, the air flow and the influent water flow rates. The output signal (dissolved oxygen) from the model is compared with the real output. This gives an estimation of the oxygen uptake rate OUR of the microorganisms, and of the oxygen transfer rate.		
Further the suspended solids concentration is studied, using the calculated OUR. From the OUR the specific growth rate for zoogleal organisms is cal- culated.		
It is difficult to verify the mass balance measurements.	e of the substrate due to insufficient	
At last some simulations are made with an	expanded model.	
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Supplementary bibliographical information		
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LUND INSTITUTE OF TECHNOLOGY	Master thesis Date of issue
Box 725	November
S 220 07 Lund 7 Sweden	Document number
Authoratel	CODEN:LUTFD2/(TFRT-5315)/1-058/(1984)
Ulf Persson	Björn Wittenmark
	Sponsoring organization
Title and subtitle	L
Reglering av system med variabel tidsför	dröjning.
(Control of systems with timevarying tim	edelav.)
Abstract	
A method for control of systems with tim	evarying time delay is investigated.
The control algoritm can be viewed as mi	nimizing the expected variance of an
auxillary signal which is a function of	the system output, input and reference
signal.	
The suvillary signal is defined in such	a way that the auxillanu.cyctom time
The auxiliary signal is defined in such	a way that the auxiliary-system time
delay are less or equal to the system ti	me delay.
The parameters in the control law are es	timated by the method recursive least-
squares from the auxillary signal.	
The only needed knowledge of the process	is the order of the process polynomials
The only needed knowledge of the process	is the order of the process porynomials
and the maximum time delay.	
The method is investigated using simulat	ion with the interactive simulation
program package SIMNON.	
It is shown that the controller can adap	t to changes in the time delay.
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S 221.00 Lund Sweden	Bocument number	
S 227 VV Land Sweden	CODEN:LUTFD2/(TFRT-5316)/1-063/(1984)	
Author(s)	Supervisor	
Bernt Nilsson	Per Hagander	
	Sponsoring organization	
Title and subtitle		
(Enzymatic hydrolysis of cellulose in two-	-phase systems.)	
Enzymatisk hydrolys av cellulosa i tvåfas	s-system.	
Abstract		
A comparison of experiment and publiced m	nodels of enzymatic hydrolysis of cellulose	
aivos		
gives:		
The three models, that have been studi	ied, predict batchwise experiments with	
satisfaction.		
The models do not give satisfactory pr	redicts for a continuousprocess.	
Ine models were not good enough for wider	studies of a continuous process, like	
for process engineering purpose or automa	atic control design.	
	J.	
A Flow Injection Analysis-system with a c	lialysis probe is a good alternativ for	
on-line analysis of enzymatic hydrolysis.	also for the purpose of automatic con-	
trol		
In a continuous two-phase process for pro	oduction of glucose a SISO-regulator can	
be used for control of allocation and		
be used for control of glucoseconcentrati	ion.	
Reconstruction should be used in controll	ing enzym activities in the process	
	ing chaym accivities in the process.	
Continuous time control desigh is enough,	because the hydrolysis dynamics is slow.	
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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.

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LUND INSTITUTE OF TECHNOLOGY	Master thesis
DEPARTMENT OF AUTOMATIC CONTROL	Date of issue
Box 118 S 221 00 Lund Sweden	Document number CODEN:LUTFD2/(TFRT-5317)/1-122/(1984)
Author(s) Magnus Taube	Supervisor Hilding Elmqvist Sponsoring organization

Title and subtitle

Grafisk presentation och editering av matematiska uttryck och reläschema.

Abstract

Input- and output to computers are generally still line oriented. With personal computers in combination with bitmapped displays it is possible to use a more sophistacated form and leave the line orientation.

A system for presentation and editing of mathematical expressions in conventional mathematical notation is implemented. Boolean expressions can also be presented as ladder diagrams.

As a separate part a compiler is implemented. The compiler takes a ladder represented by vectors and texts as input and builds up the corresponding boolean expression.

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	Document name
	Master Thesis
DEPARTMENT OF AUTOMATIC CONTROL	Date of issue
Box 118	February 1984
S 221 00 Lund Sweden	Document number CODEN:LUTFD2/(TFRT-5318)/1-048/(1984)
Author(s)	Supervisor Gustaf Olsson
Ulf Holmberg	Sponsoring organization
Title and subtitle	
Simulering av aktivslamprocessers Dynami	ĸ
(Simulation of the dynamics of estivated	
Connucation of the dynamics of activated	
Abstract This paper is built on results from dynamics of the second s	nical simulations of an active sludge
process. In the dynamical model the biold	ogical reactor (aerator) and the
secondary sedimentation basin (settler)	are considered as one system because
of the Upong internetion. The start	aludae distribución control ())
I of the wrong interactions. The strategy,	, sluage distribution control by the
return sludge flow rate, is simulated with	th different criteria. Also different
settler models are simulated.	
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Key words	9
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	Master thesis
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Box 118	December 1984
S 221 00 Lund Sweden	Document number CODEN:111TED2/(TERT=5319)/1=086/(1985)
A	
Author(s)	Björn Wittenmark
Magnus Lunadiaa Richard Svensson	Sponsoring organization
Kichard Svensson	Ericsson Radio System AB, Lund
• 111	
Cimulaning on fuckyconcentra, (Decign on	d cimulation of frequency synthesis)
Simulering av frekvenssyntes. (Design an	a simulation of frequency synthesis,
Abstract	
This master thesis describes an aid to cons	struct a Phase Locked Loop, (PLL).
The aim was to simulate and dimension a Pl	LL with it's specifications given.
The simulation language Simnon is used	d to simulate the non-linear PLL
difficulte to analyze an PLL with other met	discrete component's. Inis make it
difficulte to analyze an TEE with other met	mous than simulation.
The main problem to solve was to decreas	e the adjustment time and keep the
dampingfactor on adjacent channel's at a s	pecified level.
••• ••• •••	
It's possible with the written programs	to see what influence disturbances
and component variations have on the syst	em.
Two interactive programs have been	written. These programs make it
possible to dimension and simulate a PLI	in an easy way, without knowing
any Simnon commands.	
White marker therein has been done for	Enterne Dedie Greeken AD Lund
Supervision has been given from the Co	Ericsson Radio System AB, Lund.
Automatic Control. Lund Institute of Techn	ology.
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Key words	
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Classification system and/or index terms (if any)	
Supplementary bibliographical information	
ISSN and key title	ISBN
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LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 118 S 221 00 Lund Sweden Author(s) Mårten Lindberg	Document name Master thesis Date of issue Januari 1985 Document number CODEN:LUTFD2/(TFRT-5320)/1-040/(1985) Supervisor Gustaf Olsson Sponsoring organization
Title and subtitle Reglering av aktivslamprocessen vid AKO, (Control of an activated sludge process Abstract This master thesis has been performed at t AB Karlshamns Oljefabriker. In 1981 - 82 system with biological filters into an activa The purpose with this study has been to	Karlshamn. En förstudie. at AKO, Karlshamn. A Feasibility studie.) he wastewater treatment plant at the plant was converted from a ted sludge treatment plant. design a control system for the
The purpose with this study has been to dissolved oxygen level in the activated slu design of the plant the main part of the study necessary conditions to make control po- installation of an oxygen sensor and air regu The study concludes with a presentation of strategy for the aeration process.	adge process. Due to an inflexible dy has been devoted to create the ossible. This has been done by alators. of a computer code and a control
Key words	n l L
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Language Swedish Security classification	Recipient's notes

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LUND INSTITUTE OF TECHNOLOGY DEPARTMENT OF AUTOMATIC CONTROL Box 118 S 221 00 Lund Sweden	Document name MASTER THESIS Date of issue May 1985 Document number CODEN:LUTFD2/(TFRT-5321)/1-044/(1985)
Jonas Brånhult	Per Hagander Sponsoring organization
Title and subtitle Optimal fed-batch growth of bakers yeas (Optimal "fed-batch" -odling av jäst)	st
<pre>The set of the se</pre>	<pre>intic regulate indum media induct and the induct is derived induct is derived induct is derived induct resulting induct resulting induct and the cases three induct and induct and induct is derived induct and induct is derived induct is derived</pre>
Key words	
Classification system and/or index terms (if any) Supplementary bibliographical information	
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Language Number of pages Swedish 44	Recipient's notes
Security Classification	2

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	I Becument name	
LUND INCTITUTE OF TECHNOLOGY	Mactor thesis	
	Date of issue	
Box 118	May	
S 221 00 Lund Sweden	Document number	
	CODEN:LUTED2/(TERT-5322)/1-096/(1985)	
Author(s)	Björn Wittenmark	
Ult Adamsson	Sponsoring organization	
Title and subtitle		
Infryching av livemodol - Simuloning av o	n industriall process	
(Freezing of foods - Simulation of an ind	ustrial process.)	
Abstract		
Design and operation of industrial freezers	contains the crucial problem of	
bestign and operation of industrial neezers	aribod temperature. Methods for	
now to make the mozen loods attain a pres	scribed temperature. Methods for	
prediction of freezing times under given o	constant conditions are commonly	
used in order to calculate the optimum	product flow through continuous	
freezers. However, in reality the proces	ses are time variable, due to	
disturbances and parameter deviations.	Thus, introduction of real time	
temperature measurements combined with m	anual or automatic control would	
be a feasible way to obtain improved rel	ishility with regard to product	
be a reasible way to obtain improved rei	ability, with regard to product	
quarry.		
Freezing under time-varying conditions is a	udied using a numerical solution	
Freezing under time-varying conditions is s	udied, using a numerical solution	
method for the heat conduction equation	on with temperature-dependent	
coefficients. A mathematical model of the fre	ezing process is described, and a	
Pascal program for simulation of the Frigoscandia Gyrofreeze (spiral freezer)		
Pascal program for simulation of the Frigoso	andia Gyrofreeze (spiral freezer)	
Pascal program for simulation of the Frigoso is presented. Finally, the process dynamic	andia Gyrofreeze (spiral freezer) s are discussed and a regulator	
Pascal program for simulation of the Frigos is presented. Finally, the process dynamic structure, based on product temperature fee	andia Gyrofreeze (spiral freezer) s are discussed and a regulator dback combined with feedforward	
Pascal program for simulation of the Frigoso is presented. Finally, the process dynamic structure, based on product temperature fee from measurable disturbances (mainly air tem	candia Gyrofreeze (spiral freezer) s are discussed and a regulator dback combined with feedforward aperatures), is proposed.	
Pascal program for simulation of the Frigoso is presented. Finally, the process dynamic structure, based on product temperature fee from measurable disturbances (mainly air tem	candia Gyrofreeze (spiral freezer) is are discussed and a regulator dback combined with feedforward nperatures), is proposed.	
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	CODEN:LUTFD2/(TFRT-5323)/1-070/(1985)
Author(s)	Supervisor
NILSSON Stefan	Björn Wittenmark. Michael Lundh
SJUDIN Tor	Sponsoring organization
Title and subtitle	
AUTONOM REGIERCENTRAL . (Stand alone contr	oller)
Abstract	
Apstract	
Constructing a PID-controller by using In wide range of realtime applications. Imple foreground process consists of operator co process contains the regulator algorithm.	tel's 8052-AH Basic makes way for a emented in this construction is a ommunication while the background This makes it possible for the user
to change parameters during program execu-	tion in real-time. Control over the
system can be actived either by using a bu	itton-matris-hand terminal together
with an LLD, or by using a usual monitor	terminal.
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Key words	
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Classification system and/or index terms (if any)	
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Supplementary bibliographical information	
ISSN and key title	ISBN
L.D.C.	
Language Number of pages	Recipient's notes
Swedish 70	Sector 1
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