



PROST and NTNU Natural Gas Research Center
Department of Chemical Engineering
Department of Engineering Cybernetics
Norwegian University of Science and Technology

Literature for
**NORDIC PROCESS CONTROL
WORKSHOP 11**



January 9-11, 2003

PFI
Høgskoleringen 6 B
Trondheim
Norway

11th Nordic Process Control Workshop

Introduction

The 11th Nordic Process Control Workshop (NPCW) will be held 9-11 January 2003 in Trondheim at the PFI building (Norwegian Pulp and Paper Research Institute) on the campus of the Norwegian University of Science and Technology (NTNU). It follows previous workshops held at Wadahl (Norway) in Jan.1997, Stockholm (Sweden) in Aug. 1998, Lyngby (Denmark) in Jan. 2000, and Åbo (Finland) in Aug. 2001.

The workshop is organized by the Nordic Working Group on Process Control. The Process control groups at the Department of Chemical Engineering and Department of Engineering Cybernetics, Norwegian University of Science and Technology are responsible for the local arrangements this year. The workshop is partially sponsored by the strong point centre in PROcess Systems Engineering in Trondheim (PROST) and NTNU Natural Gas Research Center.

The objective of these workshops is to bring together the Nordic process control community, and to provide a rather informal forum for presenting recent and ongoing work in the process control area. The presentations may concern new results, ongoing research, planned research or open problems where further work is needed.

At the workshop the 6th Nordic Process Control Award will be presented to Professor Roger Sargent, Imperial College, London. Professor Sargent is widely regarded as the "father" of process systems engineering. The Nordic Process Control Award is presented to an international researcher of high merit, who has made "*lasting and significant contributions to the field of process control*". The previous recipients were Howard H. Rosenbrock (1995), Karl Johan Åström (1997), F.G. Shinskey (1998), Jens G. Balchen (2000) and Charles R. Cutler (2001).

This year the topic of the tutorial is *Optimization based control including model based control (MPC)*, and it will be given on the last day of the workshop (Saturday 11 Jan).

No printed papers are required but this volume, *Literature for the 11th Nordic Process Control Workshop*, with abstracts or reprints of recent Nordic process control publications, not necessarily directly related to the presentations, is distributed at the meeting.

11th Nordic Process Control Workshop

Program

Wednesday January 8th

- 19:30 - 20:30** **Early Registration (Hotel Augustin)**
20:30 Informal get-together at Mikrobryggeriet

Thursday, January 9th

- 09:00 - 09:05** **Opening remarks**
- 09:05 - 10:35** **Session 1: Process Modelling**
- 09:05 *Computer-Aided Modelling For Simulation And Control*
Heinz A. Preisig, TU Eindhoven, Holland
Mathieu R. Westerweele, TU Eindhoven, Holland
- 09:25 *Data-Driven Modelling Of Nonlinear And Time-Varying Processes*
Dennis Bonne, DTU, Denmark
Sten Bay Jørgensen, DTU, Denmark
- 09:45 *On The Total Least Squares And Ridge Regression Problems*
Geir Werner Nilsen, HiT, Norway
David Di Ruscio, HiT, Norway
- 10:05 *Error Estimation And Control In Discretization Of Partial Differential Equations*
Yi Liu, KTH, Sweden
Elling W. Jacobsen, KTH, Sweden
- 10:25 Discussion
- 10:35 - 11:05** **Coffee Break**
- 11:05 - 12:15** **Presentation of the 6th Nordic Process Control Award and award lecture**
- 11:05 Presentation of the 6th Nordic Process Control Award to Prof. Roger W.H Sargent
- 11:25 Award Lecture:
Modelling - A Process Systems Perspective
Roger W.H. Sargent, Imperial College, England
- 12:00 Discussion
- 12:15 - 13:15** **Lunch**

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13:15 - 15:05 **Session 2: Process Control**

- 13:15 *A Procedure For Plantwide Control With Application To A Gas Power Plant*
Marius S. Govatsmark, NTNU, Norway
Sigurd Skogestad, NTNU, Norway
- 13:35 *A Combined N And P Removal Wastewater Treatment Plant Simulation Benchmark For Control Strategy Evaluation*
Krist V. Gernaey, DTU, Denmark
Sten Bay Jørgensen, DTU, Denmark
- 13:55 *Self-Optimizing Control: Selection Of Optimal Measurement Combinations*
Vidar Alstad, NTNU, Norway
Sigurd Skogestad, NTNU, Norway
- 14:15 *Feedforward Control Under The Presence Of Uncertainty*
Audun Faanes NTNU/Norsk Hydro ASA, Norway
Sigurd Skogestad NTNU, Norway
- 14:35 *Replace all PI controllers by PIDF controllers*
Bengt Lennartson, Chalmers, Sweden
- 14:55 Discussion

15:05 - 15:30 **Coffee Break**

15:30 - 17:20 **Session 3: Nonlinear analysis**

- 15:30 *Analysis Of Nonlinear Behaviour Near Optimum*
Carsten Aarosiin Hansen, DTU, Denmark
Hong Wen Li, DTU, Denmark
Sten Bay Jørgensen, DTU, Denmark
- 15:50 *Analysis Of Feedback Behaviour In Biological Cell Reaction Networks*
Henning Schmid, KTH, Sweden
Elling W. Jacobsen, KTH, Sweden
- 16:10 *Feedback Generated High Temperature Zones In Fixed Bed Reactors*
Elling W. Jacobsen, KTH, Sweden
Marek Berezowski, Crakow University of Technology, Poland
- 16:30 *Stabilization Of Desired Flow Regimes In Two-Phase Pipelines*
Espen Storkaas, NTNU, Norway
Sigurd Skogestad, NTNU, Norway
- 16:50 *Control Of Positive Systems - Applied To Stabilization Of Gas-Lifted Wells*
Lars Imsland, NTNU, Norway
Bjarne A. Foss, NTNU, Norway
Gisle Otto Eikrem, NTNU, Norway
- 17:10 Discussion

17:30 - 18:30 **NPC Work Group**

20:00 **Dinner**

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Friday January 10th

09:00 - 10:50 **Session 4: Model Based Control**

09:00 *MIMO Uncertainty Estimation Based On Multimodel Output Matching*
Kurt-Erik Häggblom, Åbo Akademi, Finland

09:20 *Neural Network Approximation Of A Nonlinear Model Predictive
Controller Applied To A pH Neutralization Process*
Bernt M. Åkesson, Åbo Akademi, Finland
Hannu T. Toivonen, Åbo Akademi, Finland
Jonas B. Waller, Åbo Akademi, Finland
Rasmus H. Nystrom, Åbo Akademi, Finland

09:40 *Use of MPC in Statoil*
Stig Strand, Statoil, Norway

10:00 *Output Feedback Nonlinear Model Predictive Control*
Lars Imsland, NTNU, Norway
Rolf Findeisen, University of Stuttgart, Germany
Frank Allgower, University of Stuttgart, Germany
Bjarne A. Foss, NTNU, Norway

10:20 *The Computational Principles For Model Predictive Control*
John Bagterp, 2-control ApS, Denmark

10:40 Discussion

10:50 - 11:10 **Coffee Break**

11:10 -12:15 **Session 5: Industrial applications**

11:10 *Adaptive Model Based Control Of Product Quality*
Kjetil Fjalestad, Norsk Hydro ASA/HiT, Norway

11:30 *A Model For Predicting Rate-Dependent Gas-Oil Ratio From Horizontal
Wells In High-Permeability Reservoirs*
Are Mjaavatten, Norsk Hydro ASA, Norway
Robert Aasheim, Norsk Hydro ASA, Norway

11:50 *Intelligent Oil Wells*
Ivar Halvorsen Sintef, Norway

12:10 Discussion

12:20 - 13:20 **Lunch**

13:20 - 14:30 **Session 6: Applications**

13:20 *Modelling, Identification And Multivariable Control Of Wood Grinding*
Jari Boling, Åbo Akademi, Finland
Tom Forsman, Tom Forsman Consulting Ltd.
Bruno Lonnberg, Åbo Akademi, Finland

13:40 *Control Of Waste Incinerators*
Petter Lundstrøm, Energos ASA, Norway

14:00 *Mechanistic Modelling And Nonlinear Control Of Particulate Processes*
Marta Duenas Diez, HiT, Norway
Bernt Lie, HiT, Norway

14:20 Discussion

14:30 - 14:50 **Coffee Break**

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14:50 - 16:00 **Session 7: Applications**

14:50 *Modelling and Simulation of a Polyester Process*
Geir Stian Landsverk, NTNU, Norway

15:10 *Actuator Structure And Optimal Operating Region Of An Energy
Integrated Distillation*
Hong Wen Li, DTU, Denmark
Carsten Aarosiin Hansen, DTU, Denmark
Rafiqul Gani, DTU, Denmark
Sten Bay Jørgensen, DTU, Denmark

15:30 *Control And Operation Of Integrated Multieffect Distillation Columns*
Hilde Engeliien, NTNU, Norway
Sigurd Skogestad, NTNU, Norway

15:50 Discussion

16:00 - 16:10 **End of Contributed Sessions and Closing Remarks**

Saturday January 11th - Workshop: Optimisation based control including MPC

09:00 – 10:30 *MPC and on-line optimization based on first-principles models*
Tor Steinar Schei, Cybernetica AS, Norway

10:30 – 10:45 **Coffee break**

10:45 – 12:15 *Explicit model predictive control*
Tor A. Johansen, NTNU, Norway
Petter Tøndel, NTNU, Norway

12.15-12.30 Discussion

12:30 – 13:00 **Lunch**

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Registration list of participants

Denmark	Dennis Bonne	DTU	db@kt.dtu.dk
	Sten Bay Jørgensen	DTU	sbj@kt.dtu.dk
	Jose Marin Roman	DTU	jmr@kt.dtu.dk
	Krist V. Gernaey	DTU	kvg@kt.dtu.dk
	Hong Wen Li	DTU	lhw@kt.dtu.dk
	Carsten Aarosiin Hansen	DTU	caha@kt.dtu.dk
	John Bagterp Jørgensen	2-control ApS	jbj@2-control.com
	Jørgen K.H. Knudsen	FLS Automation AS	joek@flsautomation.com
England	Roger W.H. Sargent	Imperial College	r.w.h.sargent@ic.ac.uk
Finland	Jari Böling	Åbo Academi	jboling@abo.fi
	Kurt-Erik Häggblom	Åbo Academi	khaggblo@abo.fi
	Hannu Toivonen	Åbo Academi	htoivone@abo.fi
	Stefan Tötterman	Åbo Academi	stotterm@abo.fi
	Bernt Åkesson	Åbo Academi	bakesson@abo.fi
	Sirkka-Liisa J.-Jounela	Helsinki University	
	Tiina Komulainen	Helsinki University	
	Timo Malmi	Helsinki University	tmalmi@cc.hut.fi
Mikko Vermasvuori	Helsinki University		
Leif Hammarström	Neste Engineering Oy	Leif.Hammarstrom@fortum.com	
Netherlands	Heinz Preisig	TU Eindhoven	H.Preisig@tue.nl
Norway	Vidar Alstad	NTNU	vidaral@chembio.ntnu.no
	Antonio Brandao Arauso	NTNU	
	Hilde Engelién	NTNU	engelién@chembio.ntnu.no
	Marius S. Govatsmark	NTNU	msg@chembio.ntnu.no
	Eduardo S. Hori	NTNU	
	Heidi Sivertsen	NTNU	Heidi.Sivertsen@chemeng.ntnu.no
	Sigurd Skogestad	NTNU	skoge@chembio.ntnu.no
	Stathis Skouras	NTNU	skouras@chemeng.ntnu.no
	Espen Storakaas	NTNU	espensto@chembio.ntnu.no
	Federico Zenith	NTNU	zenith@chemeng.ntnu.no
	Jens Glad Balchen	NTNU	Jens.G.Balchen@itk.ntnu.no
	Bjarne A. Foss	NTNU	baf@itk.ntnu.no
	Lars Imsland	NTNU	lsi@itk.ntnu.no
	Tor Arne Johansen	NTNU	taj@itk.ntnu.no
	Geir Stian Landsverk	NTNU	geirsl@itk.ntnu.no
	Marta Dueñas Díez	Telemark University College	Marta.D.Diez@hit.no
	Kjetil Fjalestad	Telemark University College	Kjetil.Fjalestad@hydro.com
	Bernt Lie	Telemark University College	Bernt.Lie@hit.no
	Geir Werner Nilsen	Telemark University College	Geir.W.Nilsen@hit.no
	Elvira Marie B. Aske	Statoil ASA	elvira@statoil.com
	Ingvild Løvik Sperle	Statoil ASA	info@statoil.com
	Stig Strand	Statoil ASA	stra@ln.statoil.no
	Audun Faanes	Norsk Hydro ASA	Audun.Faanes@hydro.com
	Robert Asheim	Norsk Hydro ASA	Robert.Asheim@hydro.com
	Ivar Halvorsen	SINTEF	Ivar.J.Halvorsen@sintef.no
	Finn Are Michelsen	SINTEF	Finn.A.Michelsen@sintef.no
	Tor Steinar Schei	Cybernetica AS	Tor.S.Schei@cybernetica.no
Peter Singstad	Cybernetica AS	Peter.Singstad@cybernetica.no	
Petter Lundstrøm	Energos ASA	Petter.Lundstrom@energос.com	

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Sweden

Claes Breitholtz	Chalmers	cb@s2.chalmers.se
Karin Eriksson	Chalmers	ke@s2.chalmers.se
Bengt Lennartson	Chalmers	bl@s2.chalmers.se
Torsten Wik	Chalmers	tw@s2.chalmers.se
Yi Liu	KTH	liuyi@s3.kth.se
Henning Schmidt	KTH	schmidt@s3.kth.se
Elling W. Jacobsen	KTH	jacobsen@s3.kth.se
Björn Wittenmark	Automatic Control, Lund	bjorn@control.lth.se
Gunnar Berggren	Borealis AB	gunnar.berggren@borealisgroup.com

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