

## CV for SIGURD SKOGESTAD

Norwegian citizen. Born: 14 Aug. 1955 in Flekkefjord, Norway.

### Education

- 1978: M.S. (*Siv.ing.*) in Chemical Engineering at University of Trondheim, Norwegian University of Science and Technology (NTNU). Thesis: “Characterization of reaction conditions for cracking of heavy oil fractions” (Thesis advisor: Terje Hertzberg).
- 1987: Ph.D. in Chemical Engineering at California Institute of Technology (Caltech). Thesis: “Studies on Robust Control of Distillation Columns” (Thesis advisor: Manfred Morari).

### Awards and Honors

- *Innstilling* awarded for the *Siv.ing.* degree (that is, the result was communicated to the Norwegian King), 1979.
- *Fullbright Fellowship* (travel grant) awarded for graduate studies at Caltech, 1983.
- *Utdanningsstipend* awarded from Univ. of Trondheim for graduate studies at Caltech, Sept. 1983 – Feb. 1987.
- Elected member to *The Norwegian Academy of Technical Sciences* (NTVA), 1988.
- *Ted Peterson Best Paper Award* by the CAST division of AIChE (The American Institute of Chemical Engineers), 1989.
- *George S. Axelby Outstanding Paper Award* by the Control System Society of IEEE (The Institute of Electrical and Electronic Engineers), 1990 (for journal paper no. 14).
- Elected member to *Det Kongelige Norske Vitenskapers Selskab*, 1991.
- *O. Hugo Schuck Best Paper Award* by the American Automatic Control Council, 1992 (for conference paper no. 28).
- Honorary knight of the Golden Feedback Loop, NTNU, Trondheim (1994).
- Book “Multivariable Feedback Control” (Wiley, 1996) selected first runner-up for International Federation of Automatic Control award for best textbook of the last 3 years (IFAC World Congress, Beijing, 1999).

- Outstanding Service Award of the International Federation of Automatic Control (IFAC World Congress, Prague, 2005).
- *Best paper award* for paper published in 2004 in *Computers and chemical engineering* (2006). (For paper: S. Skogestad, “Control structure design for complete chemical plants”, *Computers and Chemical Engineering*, **28** (1-2), 219-234 (2004).)
- Member of IFAC Technical Board, 2008-2014.
- Elected member of Process Automation Hall of Fame, , Delaware, USA, 23 May 2011
- Elected Fellow of American Institute of Chemical Engineers (AIChE), 2012.
- Elected Fellow of International Federation of Automatic Control (IFAC), 2014.
- Elected member to *The Norwegian Academy of Science and Letters*, Oslo, 2015.
- Honorary member of *Norwegian Society of Automatic Control* (Norsk Forening for Automatisering), 2015.
- Best paper award at the ESCAPE 2019 Symposium (Eindhoven, June 2019)
- *Computing in chemical engineering award* from the American Institute of Chemical Engineers (Orlando, 12 Nov. 2019)

## Editor and Editorial Boards

- *Editor* of *Automatica* (1996-2002).
- Member Advisory Panel: *Chem. Eng. Sci.* (from 2002).
- Member Editorial Board: *Comput. Chem. Engng.* (from 2002).
- Member Editorial Advisory Board: *Ind. Eng. Chem. Res.* (2005-2009).
- Associate Editor: *Journal of Control Science and Engineering* (new web journal; from 2006)
- Designated editor: *Control Engineering Practice* (from 2006),
- Member Editorial Board: *Chem. Eng. and Processing* (2001-2007).
- Associate Editor: *European Journal of Control* (from 2009)
- Editor (reviews): *Journal of Process Control* (from 2010)

## Work experience

- 1979: Military Service at Norwegian Defence Research Center (FFI). Projects involved batteries and fuel cells.
- 1980–83: Research engineer at Norsk Hydro’s Research Center in Porsgrunn, Department of Chemical Engineering. Projects involved process modelling, simulations and thermodynamics. Appointed Group leader of the Process Modelling and Simulation Group in 1983.
- 1983–87: Ph. D. student and Research Assistant at California Institute of Technology
- 1987– present : Professor in Chemical Engineering at NTH (after 1997: name changed to NTNU).
- 1994–95: Visiting Professor at University of California, Berkeley (Departments of Chemical Engineering and Mechanical Engineering).
- 2001–02: Visiting Professor at University of California, Santa Barbara (5 months).
- Jan. 1999 – July 2009: Head of Department of Chemical Engineering, NTNU.

## Publications

- Author of 3 books. (1) S. Skogestad and I. Postlethwaite, “Multivariable feedback control - analysis and design,” Wiley (1996); *2nd Edition* (2005). (2) S. Skogestad, “Prosessteknikk” (In Norwegian), Tapir Publishers (2000). Second edition (2003). Third Edition (2009) (3) S. Skogestad, “Chemical end energy process engineering”, CRC Press (2009).
- About 200 international journal publications.
- About 300 publications at international conferences
- H-index (ISI): 46 (2019)
- Citations (ISI): 8053 (2019)
- Publications (ISI): 335 (2019)
- H-index (Google scholar): 67 (2019)
- Total no. of citations (Google scholar): 27405 (2019)
- No. of citations to book by Skogestad and Postlethwaite, *Multivariable Feedback control*, Wiley (1996, 2005) (Google scholar): 8538 (2019)

See separate publication list for details.

## Invited plenary/keynote lectures

- “Analysis and Control of Distillation Columns”, CHISA '87, Praha, Sept 1987.
- “Towards integrating design and control: Use of frequency-dependent tools for controllability analysis”, Process Systems Engineering (PSE) '91 Canada, Aug. 1991.
- “Controllability assessment as a tool for control structure selection”, *Invited lecture at IMA Workshop on Control system design for advanced engineering systems: Complexity, uncertainty, information and organization*, Institute for Mathematics and Its Applications, Minneapolis, 13 Oct. 1992
- “Dynamics and Control of Distillation Columns - A Critical Survey”, *IFAC-symposium DYCORN+ '92*, Maryland, Apr. 1992
- “Robust multivariable control using  $H_\infty$  methods – Analysis, design and Industrial Applications”, Invited short course at 1993 European Control Conference (with I. Postlethwaite), July 1993.
- “Interactions between process design and control”, CHISA'93, Praha, Aug.-Sept., 1993.
- “Input-Output Controllability Analysis”, Reglermöte, Västerås, Sweden, Oct. 1994.
- “Dynamics and control of distillation columns - A tutorial introduction”, *Symposium Distillation and Absorption 97*, Maastricht, Netherlands, Sept. 1997.
- S. Skogestad, “Plantwide control” Invited talk at Tutzing Symposium, Germany, 11 March 1998
- S. Skogestad, “Control structure design and plantwide control - The search for the self-optimizing control structure” , Invited talk at 1998 Process Systems Engineering Seminar Series, Imperial College, London, 22 May 1998
- “Self-optimizing control: the missing link between steady-state optimization and control”, Process Systems Engineering (PSE) 2000, Keystone, Colorado, July 2000.
- “Plantwide control - towards a systematic procedure”, European Symposium on computer-aided process engineering (ESCAPE'12), The Hague, Netherlands, May 2002.
- “Feedback control theory: An overview and connections to biochemical systems theory”, 7th Intl. Symp. on Biochemical systems theory. Averoy, Norway, 17-20 June 2002

- “Control structure design: What should we control, measure and manipulate?”, First African Control Conference, Cape Town, South Africa, 03-05 December 2003.
- ”Feedback: the simple and best solution”, , Invited interactive Web-CAST lecture (American Institute of Chemical Engineers’ Division for Computing and Systems Technology), 09 February 2006.
- “The dos and don’ts of distillation column control”, *Symposium Distillation and Absorption 2006*, London, UK, Sept. 2006.
- “Self-optimizing Control: Simple Implementation of Optimal Operation”, *27th Benelux Meeting on Systems and Control*, 18-20 March 2008, Heeze, Netherlands.
- “Feedback: Still the best and simplest solution”, *4th IEEE conference of industrial electronics and applications (ICIEA)*, 25-27 May 2009, Xi’an, China.
- ”A systematic approach to plantwide control”. Invited plenary talk at ICCAS, Seoul, 28 Oct 2011.
- ”Optimal PI-Control and Verification of the SIMC Tuning Rule”, Invited plenary talk at IFAC Conference PID’12, Brescia, Italy, March 2012.
- ”Economic plantwide control”. Invited plenary talk at AMIDIQ, San Jose del Cabo, Mexico, 01 May 2013
- ”Optimality of PID control for process control applications”, Invited plenary lecture at the 5th International Symposium on Advanced Control of Industrial Processes (ADCONIP 2014), Hiroshima, Japan, May 2014.
- 03 June 2015. Invited keynote semiplenary at PSE-ESCAPE in Copenhagen.
- ”Economic plantwide control”, Invited plenary lecture at Chinese Process Control Conference, Nanchang, China, 01 Aug. 2015
- 02 Dec. 2015, Invited lecture at ETH, Zurich (ICB series): ”Devising control structures for complete chemical plants - From art to science”
- 20 June 2016. Invited talk on plantwide control at FIPSE-3 (Georgakis) Rhodos, Greece.
- 19 Jan. 2017. Invited talk at DNVA, Oslo (The Norwegian Academy of Science and Letters) on ”self-optimizing control”.
- 09-10 February 2017. Invited talks (PID and plantwide) at ”XV Simposio CEA de Ingeniera de Control: Control Total de Planta”, University of Salamanca, Spain.

- 29 May 2017. Invited plenary on plantwide control at AdCONIP 2017 (6th International Symposium on Advanced Control of Industrial Processes), Tapei, Taiwan.
- 07 June 2017. Invited plenary on plantwide control at the 21st International Conference on Process Control, Strbsk Pleso, High Tatras, Slovak Republic.
- June 2018. Paper selected for keynote presentation. 28th European Symposium on Computer Aided Process Engineering, Graz
- July 2018 Keynote speaker, 1st International workshop on Advanced Methods for Control and Estimation of Dynamic systems, Shanghai, China
- July 2018 Keynote speaker, CUHK Shenzhen-TBSI International Workshop on Machine-learning for Industrial Intelligence, Shenzhen, China.
- Oct. 2018 Plenary speaker, IEEE 22nd International Conference on System Theory, Control and Computing, Sinaia, Romania.
- Jan. 2019 Plenary speaker, Process Systems Engineering (PSE) Asia, Bangkok
- Seo. 2019 Plenary speaker, RICCCE 21 (21st Romanian International Conference on Chemistry and Chemical Engineering), Constanta, Romania
- 13 Oct. 2021. Plenary speaker at the Mexican Control Conference, CNCA 2021 (virtual)
- 27 Oct. 2021. Plenary speaker at the Brazilian Chemical Engineering Conference, COBEQ 2021 (virtual)
- 08 Dec. 2021. Plenary speaker at the Control Conference of Africa (CCA), Magaliesburg, South Africa (virtual)
- 13 June 2022: Plenary talk on "Putting optimization into the control layer using the magic of feedback control", at ESCAPE-32 conference, Toulouse, France [slides]
- 17 Aug. 2022: Plenary talk on "Advanced regulatory control - a new beginning" at IFAC Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing (MMM 2022), Montreal. Canada

### **Some other activities**

- Chair of the PhD (d1r.ing.) committee for the Faculty of Chemistry and Chemical Technology NTH (1989-1993)

- Chair of the University committee for engineering PhD (dr.ing.) (1995 - 1999)
- Founding chair of the Nordic Process Control Working group (1994-1998)
- Board member of Norwegian Academy of Technical Sciences (NTVA) (1992- 1999)
- Head of NTNU/SINTEF's strong point center in process systems engineering (PROST) (1994 - ),
- Chair of NTHs fund (1996 - 2002)
- Board member of Professorforum NTH (1991-1993), Chair of Professorforum NTNU (1997-2001),
- Board member at the Faculty of chemistry and biology NTNU (1996-1999),
- Member of the Norwegian research council expert network (1998-2002)
- Member of the Jury for Norsk Hydro's Birkeland Award, 1999-2002
- Chair of the International Federation of Automatic Control (IFAC) coordinating committee on *Process and Power Systems (CC6)* and member of the IFAC Technical Board, 2008-2014
- Member European Union control council (EUCA) (2007-2013)
- Chair of National Committee for following up International Evaluation of Chemistry Research in Norway (2009-2010)
- Chair of Nordic Process Control Workshop, Trondheim-Bodo, January 2015 (about 70 participants)
- Chair of National Organizing Committee, *11th IFAC Symposium on Dynamics and Control of Process Systems, including Biosystems (DYCOPS-CAB 2016)*, Trondheim, Norway, 06-08 June 2016 (about 300 participants).
- Director of SUBPRO from 2015 and onwards. This is a center for research-based innovation subsea production and processing at NTNU funded by the Research Council and Industry. Budget is about 35 million NOK per year (2015-2023).
- International Program Committee (IPC) Chair for 3rd IFAC Conference of Automatic control in offshore oil and gas production, May/June 2018, esbjerg, Denmark.

## Additional Professional Activities

- Member/Fellow (2012) of American Institute of Chemical Engineers (AIChE), The Institute of Electrical and Electronic Engineers (IEEE), Norwegian Chemical Society (NKS), Norwegian Society of Professional Engineers (Tekna), Norwegian Petroleum Society (NPF).
- Chairman of Organizing Committee for NTVA Seminar on Chemical Engineering 40 years in Norway, Trondheim, Aug. 1989.
- Chairman of international program committee for symposium PSE-ESCAPE'97, Trondheim, Norway, May 1997.
- Member of international program committee and/or session chairman for a large number of international conferences.
- Member of European Federation of Chemical Engineers working group on Computer-Aided Chemical Engineering (1990 - )
- Member of European Federation of Chemical Engineers working group on Distillation and Absorbtion (1998 - )
- *Member of evaluation committees professorship:* Telemark College (1990), Luleå Technical University, Automatic control (1997), Lund University, Automatic control (1999).
- External Examiner at the University of Dar es Salaam, Tanzania, on three occasions: March 1988, April 1989 and March 1991.
- *Reviewer for:* AIChE J., Automatica, Canadian J. of Chem. Eng., Chem. Eng. Res. Des. (UK), Chem. Eng. Sci., , Comp. and Chem. Engng., Ind. Eng. Chem. Res., Int. J. of Control, Int. J. of Adaptive Control and Signal Processing, Int. J. of Robust and Nonlinear Control, IEEE Trans. of Autom. Control, National Science Foundation (US), J. of Process Control, Systems and Control Letters.

## Teaching, Master students, Doctoral students, Doctoral examiner

- Teaching: See separate
- Advisor for about 110 Diploma (Master) students
- Advisor for about 30 graduated Ph.D. students
- *External examiner at PhD defences (until 2008)*
  - Kurt Erik Häggblom, "Consistent control structure modeling with application to distillation control", Åbo Akademi, Finland, Dec. 1988.



- Charlotte Stub Nielsen, "Multivariable identification and control of an experimental distillation column with heat pump", DTH, Denmark, May 1990.
- Anders Karlström, "Modelling of packed bed distillation columns", CTH, Sweden, April 1991.
- John Delich, "The role of excess manipulated variables within control system development", Univ. of Sydney, Australia, Sept. 1992 (written statement only).
- Ronaldo G. Correa, "Control design of heterogeneous azeotropic distillation plants", DTH, Denmark, Oct. 1992.
- Stephen Walsh, "Integrated design of chemical waste water treatment systems", Imperial College, UK, July 1993.
- Ghassan A. Murad, "Robust multivariable control of industrial processes: A discrete-time multi-objective approach", University of Leicester, UK, Oct. 1995.
- Johan Pensar, "Parametric methods for optimal and robust control", Åbo Akademi University, Finland, Feb. 1996.
- Yi Cao, "Control structure selection for chemical processes using input-output controllability analysis", University of Exeter, UK, March 1996.
- Jobert Ludlage, "Controllability analysis of industrial processes", Eindhoven University of Technology, Netherlands, November 1997.
- Samara D. Chenery, "Process controllability analysis using linear and nonlinear optimisation", Imperial College, London, Jan. 1998
- Thomas E. Guttinger, "Multiple steady states in azeotropic and reactive distillation", ETH, Zurich, June 1998.
- Jens Erik Hansen, "Plant wide dynamic simulation and control of chemical processes", Technical University of Denmark, Lyngby, June 1998.
- Mads E. Hangstrup, "Strategies for industrial multivariable control - with application to power plant control", Aalborg University, Denmark, Feb 1999.
- Thomas S. Brinsmead, "Limits of controlled performance: Closing the gap via optimisation", Univ. of Newcastle, Australia, Dec. 1999 (written statement only).
- Sander Groenendijk, "Plantwide controllability and structural optimization of plants with recycle", University of Amsterdam, March 2000.
- Torben Ravn Andersen, "Operating design and operation of process integrated distillation", Technical University of Denmark, Lyngby, November 2002.

- Shehzaad Koachali, “Development of process synthesis tools for reaction and separation networks”, University of Witswatersrand, South Africa, June 2003 (written statement only).
  - Birgitta Kristiansson, “PID controllers design and evaluation”, Chalmers University of Technology, Sweden, August 2003.
  - Simon T. Holland, “Column profile maps: A tool for the design and analysis of complex distillation systems”, University of Witswatersrand, South Africa, November 2005 (written statement only).
  - Ola Sltteke, “Modeling and Control of the Paper Machine Drying Section”, Lund University of Technology, Sweden, January 2006.
  - N.V.S.N. Murthy Konda, “Plant-wide control of industrial processes using rigorous simulation and heuristics”, National University of Singapore, 2006 (written statement only).
  - Nipen M. Shah, “Targeting and multi-objective optimisation of gas-phase refrigeration processes for LNG”, Monash University, Australia, 2008 (written statement only)
  - Karin Eriksson, “Towards improved control of TMP refining processes”, Chalmers University of Technology, Sweden, June 2009.
  - Satyajit K. Wattamwar, “Identification of low order models for large scale processes,”, TU Eindhoven, Netherlands, 08 February 2010.
  - Martin Kragelund, “Optimal fuel strategy for portfolio profit maximization”, Aalborg University, Denmark, 17 February 2010.
  - Jin Guang Yu, “Modelling and optimization of building HVAC systems”, Nanyang Technological University (NTU), Singapore. Nov. 2011 (written statement only)
  - Per-Ola Larsson, “Optimization of Lower-Level Controllers and High-Level Polymer Grade Changes”, Lund University, Sweden, 11 November 2011
- *Examiner at PhD defences at NTNU:* 1) Dag Ljungquist, “Online estimation in nonlinear state-space models with application to catalytic cracking”, Div. of Eng. Cybernetics, 1990. 2) Peter Singstad, “Modeling and multivariable control of high pressure autoclave reactors for polymerization of ethene”, Div. of Eng. Cybernetics, 1992. 3) Erling Aa. Johannessen, “Synthesis of dissipative output feedback controllers: Application to mechanical systems”, Div. of Eng. Cybernetics, April 1997. 4) Bente H. Sannæs, “Solids movement and concentration profiles in column slurry reactors”, Dept. of Chemical Engineering, May 1997. 5) Knut Bakke, “Experimental and theoretical study of reflux condensation”, Dept. of Refrigeration and Air Conditioning, Dec. 1997. 6) Olav Slupphaug, “On robust constrained nonlinear control and hybrid control: BMI- and MPC-based state-feedback schemes”, Dept. of Eng. Cybernetics, Dec. 1998. 7) Gelein

M. de Koeijer, “Energy efficient operation of distillation columns and a reactor applying irreversible thermodynamics”, May 2002. 8) Steinar Kols, “Estimation in nonlinear constrained systems with severe disturbances”, Oct. 2008. + more missing ...

## Teaching Responsibilities

I am responsible for the course Process Control (approx. 60 students each year).

In addition, I teach a “crash course” in process control (about 6 lectures) as part of the course Separasjonsteknikk.

I also coteach two modules for the 5th year specialization: Advanced process control and sometimes Special topics (distillation) .

In the years 2009-2017 I taught the distillation, absorption and extraction part (50%) of the course TKP4105 Separation Technology for the 3rd year Chemical Engineering students.

In the years 1998-2003 and also in 2018, I taught the course TKP4120 Prosestetikk (Material and energy balances) for students in the 2nd (or 1st) year of Chemical Engineering and 3rd year of petroleum engineering. The course is based on my text book.

Every year I offer a PhD course based on my book on Multivariable feedback control: KP8115. Advanced process control

In the years 1989-1999: PhD course (at Division of Electrical Engineering): 43917 Multivariable Frequency Analysis (approx. 10 students each year). The course is now replaced by a 4th year course on ”Advanced Control of Industrial Processes” by Professor Morten Hovd.

## Graduated PhD students (with present affiliation)

1. Thor Mejdell, *Estimators for product composition in distillation columns*, Nov. 1990. (SINTEF, Trondheim)
2. Elling W. Jacobsen, *Studies on dynamics and control of distillation columns*, Dec. 1991. (Professor at KTH, Stockholm)
3. Morten Hovd, *Studies on control structure selection and design of robust decentralized and SVD controllers*, Oct. 1992. (Professor at Engineering Cybernetics, NTNU, Trondheim)
4. Knut W. Mathisen, *Integrated design and control of heat exchanger networks*, April 1994. (Yara, Porsgrunn)
5. Erik A. Wolff, *Studies on control of integrated plants*, July 1994. (Worked with ABB in Olso; deceased 2004)
6. Eva Sørensen, *Studies on optimal operation and control of batch distillation columns*, Aug. 1994 (Professor at University College, London)

7. H. Petter Lundström, *Studies on robust multivariable control of distillation columns*, Aug. 1994. (Energos, Trondheim)
8. John C. Morud, *Dynamics and control of integrated plants with reactors*, Apr. 1996. (SINTEF, Trondheim)
9. Ying Zhao, *Studies on modeling and control of continuous biotechnical processes*, Aug. 1996. (Cominco, Canada)
10. Atle C. Christiansen, *Studies on optimal design and operation of integrated distillation arrangements*, Jan. 1998. (Point Carbon, Oslo)
11. Kjetil Havre, *Studies on controllability analysis and control structure design*, Feb. 1998. (SPT Group, Oslo)
12. Bernd Wittgens, *Experimental verification of dynamic operation of continuous and multivessel batch distillation*, Dec. 1999. (SINTEF, Trondheim)
13. Truls Larsson, *Studies on plantwide control*, Aug. 2000. (Aker Kver, Stavanger)
14. Eva-Katrine Hilmen, *Separation of azeotropic mixtures: Tools for analysis and studies on batch distillation operation*, Des. 2000. (ABB, Oslo)
15. Ivar J. Halvorsen *Minimum energy requirements in complex distillation arrangements*, May 2001. (SINTEF, Trondheim)
16. Marius S. Govatsmark, *Integrated optimization and control*, Sept. 2003. (Equinor/Statoil, Haugesund, now Trondheim)
17. Audun Faanes, *Controllability analysis and control structures*, Sept. 2003. (Equinor/Statoil, Trondheim)
18. Hilde K. Engelen, *Process integration applied to the design and operation of distillation columns*, March 2004. (Aker Kver, Trondheim)
19. Stathis Skouras, *Heteroazeotropic batch distillation: Feasibility and operation*, May 2004. (Equinor/Statoil, Haugesund/Trondheim)
20. Vidar Alstad, *Studies on selection of controlled variables*, June 2005. (Yara, Porsgrunn)
21. Espen Storakaas, *Stabilizing control and controllability: Control solutions to avoid slug flow in pipeline-riser systems*, June 2005. (ABB, Oslo)
22. Antonio C.B. Araujo, *Studies on plantwide control*, Jan. 2007. (Ass. Prof., Federal University of Campina Grande, Brazil)
23. Tore Lid, *Data reconciliation and optimal operation - With applications to refinery processes*, June 2007 (Equinor/Statoil, Bergen)

24. Federico Zenith, Control of fuel cells, June 2007 (SINTEF Cybernetics, Trondheim)
25. Jrgen B. Jensen, Optimal operation of refrigeration cycles, May 2008 (ABB, Oslo)
26. Heidi Sivertsen, Stabilization of desired flow regimes using active control, December 2008 (Equinor/Statoil, Stjrdal)
27. Elvira M. Bergheim (Aske), Design of plantwide control systems with focus on maximizing throughput, March 2009 (Equinor/Statoil, Trondheim)
28. Andreas Linhart, An aggregation model reduction method for one-dimensional distributed systems, Oct. 2009 (Conergy AG, Hamburg).
29. Henrik Manum, Simple implementation of optimal control for process systems, Nov. 2010 (Cybernetica, Trondheim; from 2012: Equinor/Statoil, Trondheim).
30. Jens P. Strandberg, Optimal operation of dividing wall columns, June 2011 (Aker Solutions, Oslo).
31. Johannes Jhke, Invariants for optimal operation of process systems, June 2011 (Professor NTNU, Trondheim).
32. Magnus Glosli Jacobsen, Identifying active constrain regions for optimal operation of process plants, Nov. 2011 (ABB, Oslo).
33. Mehdi Panahi, Plantwide control for economically optimal operation of chemical plants - Application to GTL plants and CO<sub>2</sub> capturing processes, Dec. 2011 (Aker Solutions, Oslo; From 2014: Faculty at Ferdowsi University of Mashad).
34. Ramprasad Yelchuru, Quantitative methods for controlled variable selection, June 2012 (SINTEF, Trondheim; 2013: ABB, Oslo; 2017: Honeywell, Bangalore, India).
35. Deeptanshu Dwivedi, Control and operation of dividing-wall columns with vapor split manipulation, Jan. 2013 (ABB, Oslo).
36. Esmail Jahanshahi Control solutions for multiphase flow: Linear and nonlinear approaches to anti-slug control, Oct. 2013 (Siemens, Trondheim/Oslo).
37. Maryam Ghadrhan Optimal operation of Kaibel columns, Oct. 2014 (Equinor/Statoil, Stavanger).
38. Vinicius de Oliveira Optimal operation strategies for dynamic processes under uncertainty, Apr. 2016 (Kjelda, Trondheim).

39. Julian Straus Optimal Operation of Integrated Chemical Processes – With Application to the Ammonia Synthesis, Aug. 2018 (SINTEF Energy, Trondheim).
40. Chriss Grimholt Optimal tuning of PID controllers – And the verification of the SIMC rules, Dec. 2018 (ABB Industri, Oslo).
41. Dinesh Krishnamoorthy Novel approaches to online process optimization, Nov. 2019 (postdoc NTNU; 2022: Assistant Professor Eindhoven).
42. Adriana Reyes Lua Systematic design of advanced control structures, Feb. 2020 (SINTEF Energi, Trondheim).
43. Cristina Zotica Optimal operation and control of Thermal Energy Systems, Feb. 2023 (SINTEF Energi, Trondheim; 2023: Equinor).
44. Allyne Machado dos Santos Modelling, Control, and Optimization of a Recirculating Aquaculture System, Oct. 2023 (Deep Seed Solutions, Rio de Janeiro).
45. Saket Adhau Data-Driven Control Strategies: From MPC to Reinforcement Learning, Jan. 2024 (ABB Oslo; May 2024: SINTEF Trondheim).
46. Lucas Ferreira Bernardino Optimal operation with changing control objectives, May 2024 (SINTEF Energy).
47. Risvan Dirza Coordinated Feedback-optimizing Control for Large Scale Processes - with applications of field-wide oil & gas production system, June 2024 (Equinor).

**Co-supervisor/Host for (incomplete list):**

1. Bjørn Glemmestad, *Optimal operation of integrated processes. Study on heat recovery systems*, Telemark Institute of Technology, Dec. 1997 (Supervisor: Truls Gundersen) (Borealis, Porsgrunn)
2. Michela Mulas, *Modelling and Control of Activated Sludge Processes*, University of Cagliari (Italy), Jan. 2006 (Supervisor: Roberto Baratti) (Univ. Helsinki)
3. Veerayut Lersbamrungsuk, *Development of control structure design and structural controllability for heat exchanger networks*, Kasertart University (Thailand), Jan. 2008 (Supervisor: Thongchai Srinophakun)
4. Junping Cai, *Control of Refrigeration Systems for Trade-off between Energy Consumption and Food Quality Loss*, Aalborg University (Denmark), Aug. 2008 (Supervisor: Jakob Stoustrup) (Danfos, Denmark)
5. M. Nabil, *Optimal selection of sensors and controller parameters for economic optimization of process plants, IIT Madras, India (Supervisor: Sridharakumar Narasimha), Sep. 2014.*

6. Mishiga Vallabhan K G, *Produced water treatment using hydrocyclone Theoretical and experimental studies of novel control schemes, NTNU Trondheim (Supervisor: Christian Holden), May 2022.*

## Present PhD students

1. **David Perez Pineiro (MS NTNU, 2019)** *Optimal operation of energy storage (HighEFF)*. From Aug. 2019

## BOOKS

1. S. Skogestad and I. Postlethwaite, "Multivariable feedback control - analysis and design," Wiley, Chichester, 572 pages (1996); 2nd Edition (2005). (see <http://folk.ntnu.no/skoge/book.html> for more information)
2. S. Skogestad, "Chemical and Energy Process Engineering" CRC Press (Taylor & Francis Group), 450 pages, 2009. (see <http://folk.ntnu.no/skoge/book-cep> for more information)
3. S. Skogestad, "Prosessteknikk. Masse- og energibalanser," Tapir, Trondheim, 340 pages (2000); 2nd Edition, 380 pages (2003); 3rd Edition 387 pages (2009). (see <http://folk.ntnu.no/skoge/bok.html> for more information)

## Ph.D. THESIS

S. Skogestad, "Studies om robust control of distillation columns," Ph.D. thesis, California Institute of Technology, Feb. 1987 (452 + 10 pages).

## PUBLICATIONS

2021

1. V Khezri, M Panahi, E Yasari, S Skogestad Application of Surrogate Models as an Alternative to Process Simulation for Implementation of the Self-Optimizing Control Procedure on Large-Scale Process Plants A Natural Gas Industrial Engineering Chemistry Research 60 (13), 4919-4929, 2021
2. Reyes-La, Adriana; Skogestad, Sigurd. Active Constraint Switching with the Generalized Split Range Control Structure using the Baton Strategy. IFAC-PapersOnLine 2021 ;Volum 53.(2) s. 3922-3927
3. C Zotica, D Pz-Pio, S Skogestad Supervisory control design for balancing supply and demand in a district heating system with thermal energy storage Computers Chemical Engineering 149, 107306, 2021

4. Zotica, Cristina; Alsop, Nicholas; Skogestad, Sigurd. Transformed Manipulated Variables for Linearization, Decoupling and Perfect Disturbance Rejection. IFAC-PapersOnLine 2021 ;Volum 53.(2) s. 4052-4057

2020

1. Backi, Christoph Josef; Gravdahl, Jan Tommy; Skogestad, Sigurd. Combined state and parameter estimation for not fully observable dynamic systems. IFAC Journal of Systems and Control 2020 ;Volum 13. s. - NTNU
2. Jahanshahi, Esmail; Krishnamoorthy, Dinesh; Cudas Duarte, Andres; Foss, Bjarne Anton; Skogestad, Sigurd. Plantwide control of an oil production network. Computers and Chemical Engineering 2020 ;Volum 136. s. 1-14 NTNU
3. Jienkulsawad, Prathak; Skogestad, Sigurd; Arpornwichanop, Amornchai. Control structure design of a solid oxide fuel cell and molten carbonate fuel cell integrated system: Bottom-up analysis. Energy Conversion and Management 2020 ;Volum 220. s. 1-10 NTNU
4. Krishnamoorthy, Dinesh; Skogestad, Sigurd. Linear Combination of Gradients as Optimal Controlled Variables. Computer-aided chemical engineering 2020 ;Volum 48. s. 1237-1242 NTNU
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292. Jahanshahi, Esmail; Skogestad, Sigurd , Closed-Loop Model Identification and PID/PI Tuning for Robust Anti-Slug Control, Preprints of the *10th IFAC International Symposium on Dynamics and Control of Process Systems (DYCOPS)*, Mumbai, India, Dec. 2013, pp. 233-240. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2013)
293. Grimholt, Chriss; Skogestad, Sigurd , Optimal PID-Control on First Order Plus Time Delay Systems & Verification of the SIMC Rules , Preprints of the *10th IFAC International Symposium on Dynamics and Control of*

- Process Systems (DYCOPS)*, Mumbai, India, Dec. 2013, pp. 265-270. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2013)
294. Maryam Ghadrddan, Ivar J. Halvorsen, Sigurd Skogestad, Dynamic compensation of static estimators from Loss method, Preprints of the *10th IFAC International Symposium on Dynamics and Control of Process Systems (DYCOPS)*, Mumbai, India, Dec. 2013, pp. 403-408. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2013)
295. Jhke, Johannes; Skogestad, Sigurd, Using Process Data for Finding Self-Optimizing Controlled Variables, Preprints of the *10th IFAC International Symposium on Dynamics and Control of Process Systems (DYCOPS)*, Mumbai, India, Dec. 2013, pp. 451-456. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2013)
296. de Oliveira, Vinicius; Jhke, Johannes; Skogestad, Sigurd, Dynamic Online Optimization of a House Heating System in a Fluctuating Energy Price Scenario, Preprints of the *10th IFAC International Symposium on Dynamics and Control of Process Systems (DYCOPS)*, Mumbai, India, Dec. 2013, pp. 463-468. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2013)
297. Q. K. Le, I. Halvorsen, O. Pajalic, S. Skogestad Dividing wall columns for heterogeneous azeotropic distillation Proceedings 10th International conference on Symposium Distillation and Absorption, Friedrichshafen, Germany, 14-17 September 2014, pp. 576-581, EFCE event no. 705. Published by Dechema-VDI.
298. I. Halvorsen, I. Dejanovic, Z. Olujić, K.A. Marark, S. Skogestad, Dividing wall columns for NGL fractionation Proceedings 10th International conference on Symposium Distillation and Absorption, Friedrichshafen, Germany, 14-17 September 2014, pp. 749-754, EFCE event no. 705. Published by Dechema-VDI.
299. Jahanshahi, Esmaeil; de Oliveira, Vinicius; Grimholt, Chriss; Skogestad, Sigurd A Comparison between Internal Model Control, Optimal PIDF and Robust Controllers for Unstable Flow in Risers Preprints of the *19th World Congress of the International Federation of Automatic Control*, Cape town, South Africa, Aug. 2014 pp. 5752-5759. International Federation of Automatic Control. IFAC-PapersOnLine, ISSN 1474-6670 (2014)

### Papers by coworkers (listed here for completeness)

- K. Havre, K.O. Stornes and H. Stray. "Taming slug flow in pipelines", *ABB Review*, 4/2000. pp. 55-63.

- H. Manum and C. Scali, “Closed Loop Performance Monitoring: Automatic Diagnosis of Valve Stiction by means of a Technique based on Shape Analysis Formalism”, *Symposium ANIPLA Methodologies for Emerging Technologies in Automation*, Rome, Nov. 2006. Paper (8 pages).

## Patents

- Pipeline-riser system and method of operating the same: Subsea solution for anti-slug control at offshore oilfields. Europe Patent 13174514.3 - 1605 (Issued to Siemens July 1, 2013). Inventors: Sigurd Skogestad, Esmaeil Jahanshahi.
- Method of operating a pipeline-riser system: Closed-loop model identification and PID/PI tuning for robust anti-slug control. Europe Patent 13174513.5 - 1605 (Issued to Siemens July 1, 2013) Inventors: Esmaeil Jahanshahi, Sigurd Skogestad
- Parallel Heat Exchanger Control. Europe Patent Application EU/UK Patent PCT/EP2013/059304 and GB1207770.7 Filed June 3, 2013. Inventors: Johannes Jaeschke, Sigurd Skogestad
- Anti-slug optimization, Filed about 2015. Inventors: Vinicius de Oliveira, Johannes Jaeschke, Sigurd Skogestad
- Equipment for processing of a product resulting from a caprolactone production . Patent approved 2019. Inventors: Oleg pajalic (Perstorp), John Berggren, Sigurd Skogestad, Quang-Khoa Le.

## Other lectures (without printed paper)

1. S. Skogestad, “Understanding the dynamic behavior of distillation columns”, Seminar at the Department of Chemical Engineering, University of California at Santa Barbara (UCSB), 11 Feb. 1987.
2. S. Skogestad, “Robust control of distillation columns”, Chemical Engineering Departmental Seminar, University of Maryland, 23 June 1987.
3. S. Skogestad, “Robust control of distillation columns”, Seminar at DuPont Experimental Station, Wilmington, Delaware 24 June 1987.
4. S. Skogestad, “Robust control of distillation columns”, Seminar at Shell research Center, Houston, Texas, 25 June 1987.
5. S. Skogestad, “Robust control of distillation columns”, Seminar at University of Pisa, Italy, 22 July 1987.
6. S. Skogestad, “Prosessutforming”, Presentation at *Kursdagene 1988: Konvertering av naturgass*, NTNU, Trondheim, 06 Jan. 1988, (11 pages + 7 pages Appendix; available from NIF, Oslo).



7. S. Skogestad, "The  $\mu$ -method" and "Control of distillation columns", Invited lectures at Lund University, Sweden, 06-07 Apr 1988
8. S. Skogestad, "Robust control of distillation columns", Seminar at Åbo University, Finland, 08 Dec. 1988.
9. S. Skogestad, "Why and how to publish", Engelsk-kurs, NTNU, 7. June 1989
10. S. Skogestad, "DB-control" and "Use of secondary measurements in distillation", Departmental seminar, Lehigh University, 19 June 1989
11. S. Skogestad, "Destillasjon - En interessant anvendelse av multivariable regulering", Foredrag ved *Servomøtet 1989*, NTNU, 26. October 1989
12. S. Skogestad, "Estimation of process outputs from multiple secondary measurements", Workshop *Control for profit*, University of Newcastle, 30. November 1989
13. S. Skogestad, "Frequency-dependent RGA analysis", Gjesteforelesning ved EE Dep., Caltech, 12. March 1990
14. S. Skogestad, "Statistiske og dynamiske modeller til prosessovervåkning. Myk kontra hard modellering", Foredrag ved *NKS Temadag - Miljø/kjemiometri*, Porsgrunn, 23. March 1990
15. S. Skogestad, "Multiple steady-states in distillation columns", Gjesteforelesning ved DTH, Denmark, 10. May 1990
16. S. Skogestad, "New Insights on Model-Based Estimation and Control", Foredrag ved Air Products, Allentown, 8 Nov. 90.
17. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns", Chem. Eng. Departmental Seminar, Univ. of Maryland, 9 Nov. 90.
18. S. Skogestad, "Satsvise prosesser. Optimalisering, regulering og produksjonsplanlegging - metoder", Foredrag ved Kursdagene 91, NTNU, Jan. 1991
19. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns", Chem. Eng. Departmental Seminar, Univ. of Wisconsin, 15. Feb. 91.
20. S. Skogestad, "Robust Control", Gjesteforelesning ved Sivilingeniør utdannelsen i Telemark (SiT), 22. Apr. 91
21. "Systemer med kompleks dynamikk - destillasjon som et enkelt eksempel", Foredrag NTVA, Trondheim, 24. Apr.91.

22. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns", Chem. Eng. Departmental Seminar, Auburn University, 24. June. 1991.
23. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns", Chem. Eng. Departmental Seminar, Georgia Tech, 25. June. 1991.
24. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns" and "Control of Heat Exchanger Networks", Seminars given at Centre for Process Systems Engineering, Imperial College, London, 15-16. July. 1991.
25. S. Skogestad. "Short Course on Distillation Dynamics and Control" and "Controllability Analysis using Frequency-Dependent Measures for Disturbances and Interactions", Lectures at *Nordisk Destillationsregulering Forskning Workshop*, Trondheim, Aug. 1991.
26. S. Skogestad, "Modelling and Dynamic Simulation for Process Control", , Lecture and lecture notes for seminar on *Modelling and Optimization of Chemical Processes*", NTNU, Trondheim, Aug. 1991.
27. S. Skogestad, "Inconsistency in low-order models of ill-conditioned plant", Seminar given at DTH, Denmark, 16. March 1992.
28. S. Skogestad, "Kurs i destillasjonsregulering", Statoil Mongstad, 19. March 1992.
29. S. Skogestad, "Analyse av regulerbarhet", Lecture at Norsk Forening for Automatisering (NFA) Seminar i "Integrert Prosessdesign", Oslo, 6-7. April 1992.
30. S. Skogestad, "Controllability of integrated process systems - the relation between design and control", Lecture at *Short course on Process design tools and techniques*, Trondheim, 20-21 May 1992.
31. S. Skogestad, "Analysis of multivariable control systems" - 4 lectures held at Norsk Hydro Research Centre, 13-21 July 1992.
32. S. Skogestad, "Controllability measures for disturbance rejection", Lecture at *4th Nordic Process Control Workshop*, Gøteborg, 28 Aug. 1992.
33. S. Skogestad, "Control of heat exchanger networks", Lecture at Edinburgh University, 9 Sept. 1992 and at UMIST, Manchester, 10 Sept. 1992.
34. S. Skogestad, "Controllability measures for disturbance rejection", Lecture held at Leicester University on 11 Sept. 1992.
35. S. Skogestad, "Controllability analysis for unstable plants", Seminar at DTH, Lyngby, Denmark, 9 Oct. 1992.

36. S. Skogestad, "Controllability assessment as a tool for control structure selection", *Invited lecture at IMA Workshop on Control system design for advanced engineering systems: Complexity, uncertainty, information and organization*, Institute for Mathematics and Its Applications, Minneapolis, 13 Oct. 1992.
37. S. Skogestad, "Regulerbarhet av prosesser", Foredrag ved *Kursdagene NTNU'93*, Kurs: "Økonomisk gevinst ved automatisering og drift av prosesser", Trondheim, 7-8. Jan. 1993.
38. S. Skogestad, "Controllability Analysis", Lecture at *European Forum for CAPE Research Workshop*, Trondheim, 9-10. Jan. 1993.
39. S. Skogestad, "Effect of recycle and other sources of positive feedback on the dynamics of chemical processes", Seminar at Centre for Process Systems Engineering, Imperial College, London, 19 July 1993.
40. S. Skogestad, "Dynamics, multiple steady states and control of distillation columns", Seminar at Technische Universität Berlin, 27 Aug. 1993.
41. S. Skogestad, "Effective control of distillation columns using temperature measurements", Lecture at Shell Research Center (KSLA), Amsterdam, 3 sept. 1993.
42. S. Skogestad, "Regulerbarhetsanalyse av prosesser - et middel for bedre prosessdesign", Servo-møtet'93, Norsk Forening for Automatisering,
43. S. Skogestad, "Controllability analysis", Nordic Process Control Workshop, Lyngby, Jan. 94.
44. S. Skogestad, "Plantwide control", Nordic Process Control Workshop, Lyngby, Jan. 94.
45. S. Skogestad, "A systems approach to distillation processes - The rebirth of a research area", Chemical Engineering Departmental seminars, University of California at Berkeley Jan. 23 1995, University of California at Davis Feb. 13 1995, and University of California at Santa Barbara May 9 1995.
46. S. Skogestad, "A systems approach to distillation processes - The rebirth of a research area", Seminar, University of Massachusetts at Amherst, 31 March 1995.
47. S. Skogestad, "Controllability analysis of SISO systems", Seminar, Department of Electrical Engineering, University of California at Berkeley, April 5, 1995.
48. S. Skogestad, "A systems approach to distillation processes - The rebirth of a research area (including our first results on multivessel batch distillation)", *Plenary lecture*, IFAC Symposium DYCORN+95, Helsingør, Denmark, June 8, 1995.

49. S. Skogestad, "Controllability analysis of SISO systems", Seminar, DuPont Experimental Station, Wilmington, Delaware, USA, July 28, 1995.
50. S. Skogestad, "Multivessel batch distillation", Nordic Process Control Workshop, Åland, August 1995.
51. S. Skogestad and K. Havre, "Control strategy selection and partial control", Lecture and poster, European HCM meeting on chemical process control, Imperial College, London, 14-15 September 1995.
52. S. Skogestad and J. Morud, "Analyse av ustabilitet i ammoniakk-reaktorer", Servomøtet 1995, Trondheim, Nov. 1995.
53. S. Skogestad, "Control structure design", Åbo Akademi, Finland, 15 Feb. 1996.
54. S. Skogestad, "Control structure design", Workshop on controllability analysis and plantwide control, DTU, Denmark, 21 May 1996.
55. S. Skogestad, "Selection of feedback variables for optimizing control of Petlyuk columns", Workshop on Petlyuk distillation, NTNU, Trondheim, 9 Sep. 1996.
56. S. Skogestad, "Tutorial introduction to linear model predictive control", Nordic process control Workshop, Wadahl, Norway, 12 Jan 1997.
57. S. Skogestad, "Multivariabel regulering og optimalisering", Norsk Forening for Automatisering (NFA) Årsmøteseminar, Vetre, 17. april 1997.
58. S. Skogestad, "Model based tuning of PID controllers", Norsk Hydro Research Center, Porsgrunn, 04 Aug. 1997.
59. S. Skogestad, "Important issues in process systems engineering using distillation as an example", Seminar, Aristotle University of Thessaloniki, Greece, 29 Sep. 1997.
60. S. Skogestad, "Controllability analysis and control structure design", Seminar, Department of Electrical Engineering, Eindhoven Technical University, Netherlands, 11 Nov. 1997.
61. S. Skogestad, "Introduction to controllability analysis", Taped lecture at Arizona State University, Tempe, 21 Nov. 1997.
62. S. Skogestad, "Controllability analysis and plantwide control", Short-course (4 hours) at Honeywell, Phoenix, 21 Nov. 1998.
63. S. Skogestad, "Plantwide control", Invited talk at Tutzing Symposium, Germany, 11 March 1998.

64. S. Skogestad, "Control structure design and plantwide control - The search for the self-optimizing control structure" , Invited talk at 1998 Process Systems Engineering Seminar Series, Imperial College, London, 22 May 1998.
65. S. Skogestad, "Self-optimizing control", Seminar at Automatic Control Department, ETH, Zurich, 15 June 1998.
66. S. Skogestad, "Self-optimizing control", Seminar at Department of Chemical Engineering, DTU, Lyngby, 18 June 1998.
67. S. Skogestad, "Self-optimizing control", Seminar at Department of Automatic Control, Aalborg University, 11 February 1999.
68. S. Skogestad, "Self-optimizing control", Presentation at CAPE-OPEN workshop, Toulouse, 15 June 1999 [5 handwritten transparencies].
69. S. Skogestad, "Plantwide control: The search for the self-optimizing control structure", Seminar at University of Amsterdam, 29 March 2000.
70. S. Skogestad, "Multivessel batch distillation - Experimental verification", Seminar at University of Essen, 14 June 1999.
71. S. Skogestad, "Controllability analysis and plantwide control", Talk at short-course, Trondheim, 11-12 Oct. 1999.
72. S. Skogestad, "Plantwide control: The search for the self-optimizing control structure", . Seminar at Univ. of Amsterdam, Netherlands, 29 March 2000.
73. S. Skogestad, "Plantwide control: The search for the self-optimizing control structure", . Seminar at Dow Co., Terneuzen, Netherlands, 30 March 2000.
74. S. Skogestad, "Feedback: The forgotten trick", Control group seminar, T.U. Delft, Netherlands, 11 Dec. 2000.
75. S. Skogestad, "Plantwide process control", One-day lecture series given for the Taiwanese PSE Group at National Taiwan University of Science and Technology (NTUST), Taipei, Taiwan, 12 March 2001.
76. S. Skogestad, "Feedback: The forgotten trick", Seminar at ITRI (Ind. Tech. Res. Inst.), Hsin Chu, Taiwan, 13 March 2001.
77. S. Skogestad, "Feedback: The forgotten trick", Seminar at ABB Corporate research, Billingstad, Norway, 30 March 2001.
78. S. Skogestad, "Flowsheet controllability assessment tools", Lecture at Eureca/Cache Workshop on Integration of design and control, , DTU, Lyngby, Denmark, June 2001.

79. S. Skogestad, "Feedback: The forgotten trick", Seminar at University of California, Los Angeles, 20 Nov. 2001.
80. S. Skogestad, "Feedback: The forgotten trick", , Dept. seminar at University of Colorado, Boulder, 12 Feb. 2002.
81. S. Skogestad, "Feedback: The forgotten trick", Dept. seminar at University of Texas, Austin, 14 Feb. 2002.
82. Sigurd Skogestad, "Plantwide control: Towards a systematic procedure" , Plenary lecture at European Symposium on Computer Aided Process Engineering 12, den Haag, Netherlands, 26-29 May 2002, and also presented at PROST Annual Meeting, Trondheim, 11 June 2002.
83. S. Skogestad, "Feedback control theory: An overview and connections to biochemical systems theory", , Invited lecture at VIIth International Symposium on Biochemical Systems Theory Avery, Norway, 17-20 June 2002
84. The Page Buckley Colloquia in process dynamics and control, DuPont, Wilmington, 08 Nov. 2002, "Plantwide control: What should we control?"
85. PSE-seminar at Cranfield University, 01 Sep. 2003, "A low-dimensional model of severe slugging for control design and analysis"
86. Servomtet, 23. okt. 2003, "Trends in process control"
87. 05 Jan 2004, South China University of Technology, Guangzhou, China, "Feedback: Applications to self-optimizing control and stabilization of slugging"
88. 27 April 2004, IEEE Advanced Process Control Workshop, Vancouver, Canada. 3 hours plenary on "Control structure design".
89. 29 April 2004, University of Alberta, Edmonton, Canada. Department of Chemical Engineering Seminar, "Feedback control: The simple and best solution".
90. 07 December 2004, Saudi-Arabian Section of AIChE Dinner Meeting, Dhahran, "Feedback control: The simple and best solution".
91. 04-08 December 2004, Saudi Aramco / King Fahd University of Petroleum and Minerals (KFUPM), "5-day course on Distillation column control" (with Dr. Mohammad Al-Arfaj).
92. 02 August 2005, Techinal University Berlin, "1-day course on distillation column dynamics and control".
93. 24-30 August 2005, Chulalongkorn University, Bangkok, "5-day course on plantwide control".

94. 16-17 November 2005, Statoil Mongstad, "2-day course on Distillation column control".
95. 03-07 December 2005, Saudi Aramco / King Fahd University of Petroleum and Minerals (KFUPM), "5-day course on Distillation column control" (with Dr. Mohammad Al-Arfaj).
96. 04 December 2005, Saudi-Arabian Section of AIChE Dinner Meeting, Dhahran, "Distillation: So simple and yet so complex".
97. 09 February 2006, Invited Web-CAST lecture (American Institute of Chemical Engineers' Division for Computing and Systems Technology), "Feedback: the simple and best solution".
98. 06 March 2006, University of Witswatersrand, Johannesburg, South Africa. Seminar at Department of Chemical Engineering. "Feedback: the simple and best solution".
99. 01 April 2006, Porto Allegre, Brazil. One-day course on "Plantwide control" as part of Adchem'06 conference.
100. 14 July 2006, University of Stuttgart, Germany. Kolloquium Technische Kybernetik, "Feedback: the simple and best solution. Applications to self-optimizing control and stabilization of new operating regimes".
101. 2007, 2008, some missing here..
102. 23 Jan. 2009, ETH, Zrich. Automatic control colloquium. "Self-optimizing control: Simple implementation of optimal operation".
103. 22 May 2009, Shanghai Juatong University, Automatic Control Department. "Feedback: Still the simplest and best solution".
104. 04 June 2009, CTH (Chalmers), Gteborg, Sweden. Automatic control Department. "Self-optimizing control: Simple implementation of optimal operation".
105. 21 Oct. 2009, Servomt, Trondheim. "Selv-optimaliserende og andre eksplisitte metoder for on-line optimalisering".
106. 02 Nov 2009, Statoil Research Center, Trondheim. "Feedback: Still the simplest and best solution".
107. 08 Feb 2010, Control seminar at Technal University Eindhoven, Netherlands. "Self-optimizing and explicit methods for online optimizing control: Effective Implementation of optimal operation using Off-Line Computations".
108. 10 Feb 2010, Slovak Control Conference, Visna Boca, "Feedback: Still the simplest and best solution".

109. 17 Feb 2010, Control seminar at Aalborg University, Denmark. "Practical implementation of optimal operation".
110. 18 Feb 2010, IFEA workshop on "Overordnet regulering og prosessoptimalisering, Majorstua, Oslo. "Fremtidige trender innen prosessoptimalisering".
111. 01 Mar 2010, IEEE seminar Nanyang Technical University (NTU), Singapore. "A systematic approach to plantwide control".
112. 03 Mar 2010, IEEE seminar National University Singapore (NUS). "Self-optimizing and explicit methods for online optimizing control."
113. 05 Mar 2010, Seminar Nanyang Technical University (NTU), Singapore. "Feedback: Still the simplest and best solution".
114. 09 Mar 2010, Seminar University Technology Petronas (UTP), Ipoh, Malaysia. "A systematic approach to plantwide control".
115. 22 Mar 2010, Seminar University of Sao Paulo (USP), Brazil. "A systematic approach to plantwide control".
116. 23 Mar 2010, Seminar Petrobras REVAP refinery, Sao Jose dos Campos, Brazil. "A systematic approach to plantwide control" (brief version).
117. 26 Mar 2010, Seminar COPPE/UFRJ, Rio, Brazil. "A systematic approach to plantwide control".
118. 21 Apr 2010, Seminar PIC-LU meeting, Stockholm. "A systematic approach to plantwide control".
119. 08 Nov 2010, Seminar STUBA, Bratislava. "Controlled variable and measurement selection".
120. 19 Nov 2010, Seminar EPFL, Lausanne. "Self-optimizing control."
121. 30 Nov 2010, Seminar IIT Kanpur, India, "A systematic approach to plantwide control".
122. 04 Dec 2010, Seminar IIT Madras, Chennai, India, "A systematic approach to plantwide control".
123. 23 Mar 2011, Departemental Seminar DTU, Lyngby, Denmark. "A systematic approach to plantwide control".
124. 15 Apr 2011, Seminar FMC Kongsberg Subsea, Asker. "PID tuning"
125. 20-21 July 2011, Short course Angra dos Reis, Brazil, "Plantwide control"
126. 18 Aug 2011, Summer school TU Berlin, "Distillation column dynamics and control"



127. 28 Oct 2011, Invited plenary talk at ICCAS, Seoul. "A systematic approach to plantwide control".
128. 31 Jan 2012, Motivation seminar Chemikerforeningen, Trondheim. "Selvoptimaliserende regulering"
129. 17-20 Apr 2012, Lectures at Univ. Valledolid, Spain., "Economic plantwide control".
130. 27 May 2012, Seminar at UNAM, Mexico City. "Economic plantwide control".
131. 01 May 2012, Invited plenary talk at AMIDIQ, San Jose del Cabo, Mexico. "Economic plantwide control".
132. 03 May 2012, Lecture at panel discussion AMIDIQ, San Jose del Cabo, Mexico. "Process control education".
133. 23 May 2012, Lecture at Workshop for EFChE Working Party on Fluid Separations, Bergen, Norway. "New results for divided wall columns".
134. 06-07 Jan. 2013, Short-course on "Economic plantwide control". Sharif University, Tehran, Iran.
135. 09 Jan. 2013, Seminar at Shiraz University, Shiraz, Iran. "Economic plantwide control".
136. 29 May 2013, Invited lecture at Process Industry Centre (PIC) conference in Stockholm, Sweden. "From process control to business control".
137. Some missing here
138. "Optimality of PID control for process control applications", Invited plenary lecture at the 5th International Symposium on Advanced Control of Industrial Processes (ADCONIP 2014), Hiroshima, Japan, May 2014.
139. 03 June 2015. Invited keynote semiplenary at PSE-ESCAPE in Copenhagen.
140. 01 August 2015, Invited plenary talk at Chinese Process Control Conference, Nanchang, China. "Economic plantwide control".
141. 02 Dec. 2015, Invited lecture at ETH, Zurich (ICB series): "Devising control structures for complete chemical plants - From art to science"
142. 11 Apr. 2016, One-Day short course on Plantwide control. Technion, Israel
143. 20 June 2016. Invited talk on plantwide control at FIPSE-3 (Georgakis) Rhodos, Greece.

144. 19 Jan. 2017. Invited talk at DNVA, Oslo (The Norwegian Academy of Science and Letters) on "self-optimizing control".
145. 09-10 February 2017. Invited talks (PID and plantwide) at "XV Simposio CEA de Ingeniere Control: Control Total de Planta", University of Salamanca, Spain.
146. 29 May 2017. Invited plenary on plantwide control at AdCONIP 2017 (6th International Symposium on Advanced Control of Industrial Processes), Taipei, Taiwan.
147. 07 June 2017. Invited plenary on plantwide control at the 21st International Conference on Process Control, Strbskeso, High Tatras, Slovak Republic.