

## Curriculum Vitae

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**Jan Kronqvist**

**Postdoc researcher (Royal Society – Newton International Fellow)**

**Department of Computing Imperial College London**

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### Current position

**Postdoc researcher at Imperial College London** 1.3.2019 - 28.2.2021, Royal Society - Newton International Fellow (acceptance rate for fellowship 7.5 %).

### Areas of expertise/ research interests

**Optimization:** A comprehensive understanding of methods and algorithms. My research is focused on the development of algorithms and tools for solving challenging optimization problems containing both nonlinear expressions and discrete decision variables.

**Developer of the award-winning convex MINLP solver SHOT** <https://github.com/coin-or/SHOT>

**Process Systems Engineering:** I have a broad knowledge and genuine interest in the field. Within this field, I have worked with Process Design, Process Control, and Machine learning.

**Applied Mathematics:** I have a strong foundation in mathematics, and most of my research has been within the field of applied mathematics.

### Education

**D. Sci. (Tech.),** Process Systems Engineering, Åbo Akademi University. Graduated in 2018 with honors.

**M.Sc. ,** Chemical Engineering with a minor in Industrial Management. Graduated in 2014 with honors from Åbo Akademi University.

**B.Sc.,** Chemical Engineering. Graduated in 2013 from Åbo Akademi University.

### Awards and Grants

- Awarded a **Newton International Fellowship by the Royal Society** in the UK 2018. For a postdoc project at Imperial College London (very prestigious fellowship with a 7.5% acceptance rate).
- **Grant** awarded by the Swedish Cultural Foundation in Finland to support Postdoc period at Imperial College London.
- **Prize for best Ph.D. thesis** 2018 at the Faculty of Science and Engineering at Åbo Akademi
- **Winner of the COIN-OR cup 2018**, for the open-source solver SHOT for solving convex MINLP optimization problems. Prize given during the INFORMS conference in Phoenix USA.
- **Graduated with honors** from Åbo Akademi University 2018 (D. Sci.).

Awarded to less than 10% of all Ph.D. students graduating from Åbo Akademi University.

- **Grant** awarded by Tekniska Föreningen i Finland (TFiF) in 2018, 2016, and 2015.  
To cover travel expenses for international conferences.
- **Grant** awarded by Walter Ahlstöm Foundation in 2016.  
To cover travel expenses for a research visit to Carnegie Mellon University.
- **Grant** awarded by Svenska Tekniska Vetenskapsakademien i Finland in 2016.  
To cover expenses for a research visit to Carnegie Mellon University.
- **Grant** awarded by Waldemar Von Frenckell's foundation in 2016.  
To cover expenses for research visits to Carnegie Mellon University and the University of Alicante (Spain).
- **Research grant** awarded by Tekniikan Edistämisseätiö in 2016.  
To cover expenses for my research.
- **Graduated with honors** from Åbo Akademi University 2014 (M.Sc.).
- **Grant** awarded by Åbo Akademi University for excellent study progress in 2013 and 2012.
- **First prize** in TekNatur 2008 (Finnish natural science competition for high school students). A scientific study of pulsejet engines.

### Employment Experience

- University teacher (equivalent to lecturer/instructor in the USA) in Process Systems Engineering at Åbo Akademi University 1.8.2017-27.2.2019
- Ph.D. student in the Finnish Graduate School in Chemical Engineering 2015-2018.
- University teacher (equivalent to lecturer/instructor in the USA) in Chemical Engineering at Åbo Akademi University 1.8.2014-30.7.2015.
- Researcher in the Center of Excellence in Optimization and Systems Engineering at Åbo Akademi University 15.1.2014 - 31.7.2014.
- Internship at Paroc Group 2013.
- Summer trainee at UPM-Kymmene Oyj in 2010, 2011 and 2012.
- Mandatory Military service in Finland 2009.

### Research visits / Collaborations

**Visiting researcher at Carnegie Mellon University**, Pittsburgh USA 2.1.2017-30.6.2017. A collaboration on convex mixed-integer optimization with Professor Ignacio Grossmann and Ph.D. candidate David Bernal. An ongoing collaboration which has so far resulted in two published journal papers and one submitted paper.

**Visiting researcher at University of Alicante**, Spain July 2017. A collaboration on cutting planes methods for simulation-based optimization with Professor José Caballero and Ph.D. Juan Javaloyes. An ongoing collaboration which has so far resulted in one publication.

## Teaching Experience

### **University teacher in Process Systems Engineering at Åbo Akademi University in 2017-2019.**

Lecturer and Course Leader in the courses:

Process Systems Engineering (10 EECTS) in 2017 and 2018

Process Design (5 EECTS) in 2017

Energy Technologies in the Process Industry (5 EECTS) in 2018 and 2019

### **University teacher in Environmental Technology at Åbo Akademi University in 2014-2015.**

Lecturer and Course Leader in the courses:

Environmental Process Engineering (5 EECTS)

Environmental Engineering (4 EECTS)

Environmental Science (2 EECTS)

### **Guest lecturer**

Guest lecture in the course Advanced Topics in Mixed Integer Nonlinear Programming, at **Tepper School of Business Carnegie Mellon University** 2017. Lecture on the extended supporting hyperplane method for convex MINLP.

Guest lecture in PSE seminar series at **Carnegie Mellon University** 2017. Lecture on methods and reformulations for convex MINLP.

### **Research Mentoring of Master and Bachelor students**

Mika Adler, Model-based control of air and exhaust paths in a medium speed 4-stroke internal combustion engine. **Master's Thesis**, an industrial project with the engine manufacturer Wärtsilä in 2019. **Supervisor of the thesis.**

Viktor Heir, *DEVELOPMENT OF PERFORMANCE MODELS FOR SCR AND OXIDATIONS CATALYSTS*. **Master's Thesis**, an industrial project with the engine manufacturer Wärtsilä in 2018. **Supervisor of the thesis.**

Tony Granlund, *HUR ÖKNINGEN AV ELBILAR PÅVERKAR EFÖRBRUKNINGEN OCH KOLDIOXIDUTSLÄPPEN I FINLAND*. **Bachelor's thesis** at Åbo Akademi University 2018, the thesis describes and analyses the impact of electric vehicles on the power consumption in Finland. **Supervisor of the thesis.**

Johan Frants, *AVANCERAD TURBOTEKNIK*. **Bachelor's thesis** at Åbo Akademi University 2016, the thesis analyses the benefits of advanced turbocharging techniques for internal combustion engines. **Supervisor of the thesis.**

Frans Storgårds, *ENERGIEFFEKTIVERING AV BOKRAFTVERK GENOM TORKNING AV BRÄNSLET*. **Bachelor's thesis** at Åbo Akademi University 2015, the thesis analyses the benefits of drying biofuels by low and intermediate pressure steam in power plants. **Supervisor of the thesis.**

**Teaching assistant at the Process Design and Systems Engineering Laboratory at Åbo Akademi University in 2012- 2014.**

Teaching assistant in the following courses:

- Process Systems Engineering (course held annually)
- Energy Technologies in the Process Industry (course held annually)

**Teaching assistant at the Process Control Laboratory at Åbo Akademi University in 2011-2012.**

Teaching assistant in the following courses:

- Process control
- Basic control theory

**Invited Presentations**

- Invited presentation at KTH Royal Institute of Technology, Stockholm, Sweden. Held a seminar presentation on convex MINLP.
- Invited presentation at the Nordic Process Control Workshop 2018. I organized a workshop on optimization and held a lecture on mixed-integer optimization

**Publications**

**Peer-Reviewed Journal Papers** (published or accepted for publication)

- J7** **Kronqvist J.**, Bernal D. E., Grossmann I. E. Using Regularization and Second Order Information in Outer Approximation for Convex MINLP. *Mathematical Programming*, 2018 (<https://doi.org/10.1007/s10107-018-1356-3>).
- J6** **Kronqvist J.**, Bernal D. E, Lundell A., Grossmann I. E., A Review and Comparison of Solvers for Convex MINLP. *Optimization and Engineering*, 2018 (<https://doi.org/10.1007/s11081-018-9411-8>).
- J5** **Kronqvist J.**, Bernal D. E., Lundell A., Westerlund T., A Center-Cut Algorithm for Quickly Obtaining Feasible Solutions and Solving Convex MINLP Problems, *Computers & Chemical Engineering*, 2018 (<https://doi.org/10.1016/j.compchemeng.2018.06.019> ).
- J4** **Kronqvist J.**, Lundell A., Westerlund T., Reformulations for utilizing separability when solving convex MINLP problems, *Journal of Global Optimization*, 2018. DOI:10.1007/s10898-018-0616-3.
- J3** Eronen V. P., **Kronqvist J.**, Westerlund T., Mäkelä M. M., Karmitsa N., Method for solving generalized convex nonsmooth mixed-integer nonlinear programming problems, *Journal of Global Optimization* 2017, DOI: 10.1007/s10898-017-0528-7.
- J2** Manngård M., **Kronqvist J.**, Böling J .M., Structural learning in artificial neural networks using sparse optimization, *Neurocomputing* 2018, DOI:10.1016/j.neucom.2017.07.028.

- J1 Kronqvist J.**, Lundell A, Westerlund T., The extended supporting hyperplane algorithm for convex mixed-integer nonlinear programming, *Journal of Global Optimization* 2016, DOI:10.1007/s10898-015-0322-3.

### Peer-Reviewed Conference Proceedings

- C9 Kronqvist J.**, and Lundell A. Convex MINLP – An Efficient Tool for Design and Optimization Tasks?. *Computer Aided Chemical Engineering*, 2019. <https://doi.org/10.1016/B978-0-12-818597-1.50039-4>
- C8 Lundell, A.**, and **Kronqvist J.** On Solving Nonconvex MINLP Problems with SHOT. *WCGO 2019, Optimization of Complex Systems: Theory, Models, Algorithms and Applications*, [https://doi.org/10.1007/978-3-030-21803-4\\_45](https://doi.org/10.1007/978-3-030-21803-4_45).
- C7 Lundell, A.**, and **Kronqvist J.** Integration of polyhedral outer approximation algorithms with MIP solvers through callbacks and lazy constraints. *AIP Conference Proceedings*, 2019, <https://doi.org/10.1063/1.5089979>.
- C6 Javaloyes-Antón J.**, **Kronqvist J**, Caballero J.A. Simulation-Based Optimization of Chemical Processes Using the Extended Cutting Plane Algorithm. *Computer Aided Chemical Engineering*, <https://doi.org/10.1016/B978-0-444-64235-6.50083-8>.
- C5 Kronqvist J.**, Lundell A., Westerlund T. A center-cut algorithm for solving convex mixed-integer nonlinear programming problems. *Computer Aided Chemical Engineering*, Vol. 40, <https://doi.org/10.1016/B978-0-444-63965-3.50357-3>
- C4 Lundell, A.**, **Kronqvist, J.**, Westerlund, T. SHOT–A global solver for convex MINLP in Wolfram Mathematica. In *Computer Aided Chemical Engineering*, Vol. 40, <https://doi.org/10.1016/B978-0-444-63965-3.50358-5>
- C3 Kronqvist J**, Lundell A., Westerlund T. Lifted polyhedral approximations in convex mixed-integer nonlinear programming. In *XIII GLOBAL OPTIMIZATION WORKSHOP GOW'16*, ISBN 978-989-20-6764-3
- C2 Lundell A.**, **Kronqvist J.**, Westerlund T. Improvements to the Supporting Hyperplane Optimization Toolkit Solver for Convex MINLP. In *XIII GLOBAL OPTIMIZATION WORKSHOP GOW'16*. ISBN 978-989-20-6764-3
- C1 Lundell A.**, **Kronqvist, J.**, Westerlund, T. An extended supporting hyperplane algorithm for convex MINLP problems. In *XII GLOBAL OPTIMIZATION WORKSHOP MAGO'14*, ISBN: 978-84-16027-57-6

### Conference and Workshop presentations

- Pr7** Oral presentation on the topic: Recent developments of the Supporting Hyperplane Optimization Toolkit Solver. Presentation held at EURO 2019 in Dublin.
- Pr6 Invited presenter** at the Nordic Process Control Workshop 2018.

**Pr5** *Oral* Presentation on the topic: Using Regularization and Second Order Information in Outer Approximation for Convex MINLP. Presentation held at the International Symposium on Mathematical Programming in Bordeaux 2018.

**Pr4** *Oral* Presentation on the topic: *A center-cut algorithm for convex MINLP, a deterministic solution technique or primal heuristic.* Presentation held at ESCAPE27 in Barcelona 2017.

**Pr3** *Oral* Presentation on the topic: *Lifted Polyhedral Approximations in Convex MINLP.* Presentation held at the global optimization workshop in Braga Portugal 2016.

**Pr2** *Oral* Presentation on the topic: *Solving linearly constrained nonlinear minimax problems using cutting plane techniques.* Presentation held at BFG conference at Imperial College London 2015.

**Pr1** *Oral* presentation on the topic: *An extended supporting hyperplane algorithm for convex MINLP problems.* Presentation held at the Optimization and Systems Engineering Annual Seminar in Turku Finland 2014.

### Poster presentations

**P2** Presentation on the topic: *New Techniques for Convex Mixed-Integer Nonlinear Programming.* Presentation held at the Annual Review meeting of the Center for Advanced Process Decision-making at Carnegie Mellon University 2017.

**P1** Presentation on the topic: *Solution Techniques for Convex Mixed-Integer Nonlinear Programming.* Presentation held at Åbo Akademi 2016.

### Professional Service

Reviewer in Mathematical Programming.

Reviewer in Journal of Global Optimization.

Reviewer in Optimization Letters.

Reviewer in Optimization and Engineering.

Member of the committee for renewing the B.Sc. and M.Sc. program at Åbo Akademi University.

### Dissertations

Polyhedral Outer Approximations in Convex Mixed-Integer Nonlinear Programming. Jan Kronqvist, **Ph.D. thesis, awarded with the highest grade** at Åbo Akademi 2018.

Development of measurements and control algorithms with industrial applications. Jan Kronqvist, **Master's thesis, awarded with the highest grade** at Åbo Akademi 2013.

Reglering och simulering av oscillerande vågenergikonverter. Jan Kronqvist, Title in English "Control and simulation of ocean wave energy converter". **Bachelor's thesis, awarded with the highest grade** at Åbo Akademi 2012.