



Linköping Center for Sensor Informatics and Control (LINK-SIC)

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A VINNOVA Competence Center

Welcome!
and
Summary

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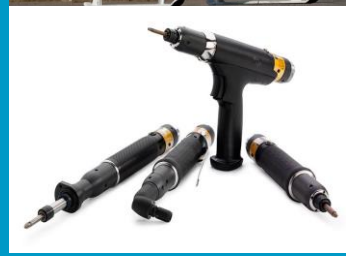


LINKÖPING UNIVERSITY

Program – 14 Nov

9.30 – 9.45 Coffee

9.45 – 10.30 Welcome. Impact of LINK-SIC. Svante Gunnarsson, LiU

10.30 – 11.50 Life as LINK-SIC PhD student and beyond: - Zoran Sjanic, Saab Aeronautics, - Oskar Leufven, Scania, - Johanna Wallén Axehill, Saab Aeronautics, - Fredrik Ljungberg, ABB

11.50 – 12.00 Poster teaser

12.00 – 14.00 Lunch and poster session

14.00 – 14.30 Chairmen's perspective: - Torgny Brogårdh, previously ABB, - Gunnar Holmberg, SAAB Aeronautics

14.30 – 15.10 Ongoing PhD projects: - Stefanie Zimmermann, LiU, - Max Johansson, LiU

15.10 – 15.40 Coffee

15.40 – 16.00 Industry perspectives:

- Shiva Sander-Tavallaey, ABB

- Jonas Holmborn, Scania

16.00 – 16.15 Summary and closing

19.00 Dinner

Summary

- Brief history
- Track record
- Activities

Brief history

- 1995 – 2005: Competence Center ISIS (Information Systems for Industrial Control and Supervision). Wider scope than current LINK-SIC in terms of companies and research groups.
- 2006: Application for a new center (OSIRIS), with an even wider scope. Rejected despite good reviews.
- 2007 – 2017: Industry Excellence Center, LINK-SIC (Linköping Center for Sensor Informatics and Control), with only Automatic control and Vehicular systems as research teams.
- 2016: Application for a competence center LINK-SIC, representing an expansion compared to the Ind Ex Center. Rejected, but became runners-up and got the chance to apply again, and this time with success.
- 2017 – 2023: Competence Center, LINK-SIC. Several new companies, including SME:s.
- 2022: Negative outcome of the 5-year evaluation, despite excellent scientific review.
- 2023: Application for a new Competence Center, SEDDIT, which was approved.

Brief history

Main change during 2007 – 2017:

- Saab Automobile went out of business.
- The ”slot” was taken over by Scania very smoothly.

Changes during the period 2017 – 2023:

- Atlas Copco Industrial Technique joined LINK-SIC from 2019.
- Newton Nordic left LINK-SIC early 2022.
- Minor changes for year six

Track record

People, processes, and products!

Track record

- PhD and Lic theses
- Master's theses
- Journal and conference papers
- Results to industry

PhD theses – 2007 - 2017

Year	Name	Partner	Current employer
2009	Johan Wahlström	Scania	Nira Dynamics
2010	Stig Moberg	ABB	ABB
2011	Johanna Wallén Axehill	ABB	Saab
2013	Zoran Sjanic	Saab	Saab
2013	Oskar Leufven	Scania	Scania
2014	Martin Skoglund	Saab	Oticon
2014	Patrik Leissner	ABB	Qualcomm
2014	André Carvalho Bittencourt	ABB	MBA-studies
2014	Andreas Myklebust	Scania	Nira Dynamics
2017	Jonas Linder	ABB	ABB

PhD theses – 2018 -2023

Year	Name	Partner	Current employer
2018	Clas Veibäck	Saab	Verizon
2018	Xavier Llamas	Scania	Applus+ IDIADA
2019	Roger Larsson	Saab	Saab
2021	Kristoffer Ekberg	Scania	Wolfram MathCore
2022	Olov Holmer	Scania	LiU
2022	Robin Holmbom	Scania	LiU
2022	Fredrik Ljungberg	ABB	ABB

Lic theses – 2018 - 2023

Year	Name	Partner	Current employer	PhD defense
2018	Du Ho Duc	Saab	Qamcom	2024
2020	Erik Hedberg	ABB	SICK IVP	
2021	Robin Forsling	Saab	Saab	Dec 15, 2023
2021	Hamed Haghshenas	ABB	NIBE	2025
2023	Stefanie Zimmermann	ABB	LiU	2025

Master's theses

- 2007 – 2017: Many
- 2018 – 2022: 47

Journal and conference papers

- 2007 – 2017: Many
- 2018 – 2022: 68

Results to industry – A lot

- New methods for system identification were developed, based on real flight test data, in the industrial PhD student project of Roger Larsson (PhD 2019) at Saab. The new methods have the potential to reduce the time for flight tests, hence saving fuel and other company resources, and through this work Roger Larsson has successfully brought new knowledge and methods into the company to be used for future evaluation and implementation.
- A new simulation model for thermal management in battery systems was developed in one of the student summer projects at Alelion. The model was then further developed in a subsequent Master's thesis by Simon Malmgren, and new, innovative ideas developed within the thesis work finally resulted in a patent. The documentation of the summer projects is found via the links to the annual workshops on the web site.
- In a Master's thesis performed at ABB Robotics, Johanna Heide and Mattias Granström implemented and evaluated new methods for dead-time compensation in the electric drive systems in the robot controller, with potential to give considerable improvement of the performance of the robot. Mattias Granström was later recruited to the company, and the method is subject to further studies for implementation.
- As a result of the participation in LINK-SIC, Senion has got access to the special funding for SMEs from Vinnova. Two individual SME projects, endorsed by the LINK-SIC board and performed in cooperation and discussion with other LINK-SIC partners, have led to faster installation and calibration of the company's indoor positioning system.
- Two student summer projects performed at UMS Skeldar have been evaluating sensors for inertial navigation, and the work has demonstrated a direct impact on the performance of the product. In a third project, the results about modeling of waves and ship dynamics will be included in the tools used in the product development process.
- Initiated at an area meeting at the company Newton Nordic, two summer projects have dealt with modeling and model-based regulator design of a motorized gimbal system. The work has shown the potential to simplify the regulator tuning process gaining improved performance as a result.
- During his stay within LINK-SIC, Marcelo Costa from UFMG, Brazil, developed machine learning methods for analysis of data for faults in industrial robots in collaboration with ABB Robotics. The results provided new insights into the pattern of the faults, and the methods are under consideration for further development and use at the company.
- Senion has hosted four summer projects, where the first one was to develop a proof-of-concept in collaboration with another LINK-SIC partner, and the three following projects resulted in direct improvements of the product.
- A state-of-the-art air mass flow model for dual independent cam phaser engines which is a necessity
- for future engine emission fulfilment, has been implemented in the new Scania Super motor platform and published as both a Master's Thesis and a conference paper. In addition, a state-of-the-art turbo compressor controller has been developed for the new Scania Super motor platform.
- Researchers from the Vehicular systems have given the course "Electrical engineering for engineers" (Ellära för ingenjörer) at Scania.
- In collaboration with Scania, turbo compressor models used for model parameterization for engine control software have been developed.

Example: More resource efficient flight-test

Industrial challenges:

- Reduce the time and costs for flight tests.
- Best possible use of data from flight tests.

Scientific challenges:

- Experiment design
- Improved methods for system identification based on flight test data.

PhD thesis 2019. 4900+ downloads (according to DiVA)

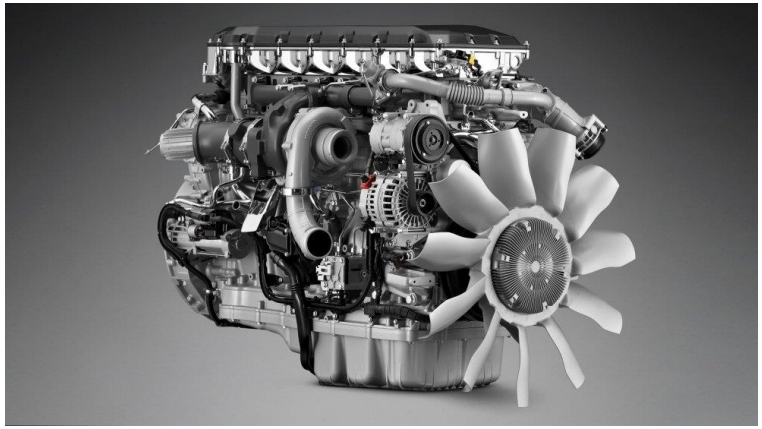
- People and processes!

Example: Contributions to the Scania Super engine platform

Industrial challenges:
- Higher energy efficiency
- Reduced emissions

Scientific challenges:
- Modeling, optimization, and control

For example:
- Master's thesis by Elina Fantenberg, 2018. 4300+ downloads (according to DiVA)



- People and product!

Activities

- Annual workshops
- Summer projects
- Inspiration lectures
- ……

Annual workshops

- 2007 – 2011: LiU
- 2012: ABB
- 2013: Saab
- 2014: Scania
- 2015: KU Leuven
- 2016 - 2017: LiU
- 2018: Saab
- 2019: ABB
- 2020: Distance mode
- 2021: Hybrid (LiU)
- 2022: Atlas Copco & Scania
- 2023: LiU

Core competence and thematic workshops

- Learning methods in control
- Numerical optimization
- Batteries
- Reinforcement learning (distance mode), course material developed
- Friction
- Modeling and control of after-treatment systems
- Robust and adaptive control

Summer projects

Setup:

- The companies have proposed tasks suitable for six weeks of work for one/two students.
- The summer projects have been announced and suitable candidates have been selected by the LINK-SIC management team.
- The students have been hired by LINK-SIC and worked on the projects during summer, with, if needed, some supervision from LINK-SIC.
- The results have been presented at the poster sessions at the annual workshop.

Summer projects

- 2018:
  - Alelion - Thermal Model of Lithium-Ion Battery Cell
  - UMS Skeldar- An Experimental Project of Inertial Navigation and Relative Positioning Performance
  - Actia/Senion - ACTIA–Senion Summer Project
- 2019:
  - Alelion - Log data digestion and analysis
  - UMS Skeldar - Test and Evaluation of Navigational Receivers
  - Senion - Summer project: Updating an Android app
  - Intuitive Aerial (Newton Nordic) - Developing a Figure of Merit for Image Stability

Summer projects (cont)

- 2020:
  - Senion - Business Intelligence Web Portal
  - Alelion - IoT Industrial Battery Surveillance
  - Newton Nordic - Model estimation of a camera stabilizing system
- 2021:
  - Newton Nordic - Modeling of a Motorized Gimbal System
  - UMS Skeldar - Modeling of waves and ship motion
  - Senion - Business Intelligence Web Portal
- 2022 (Summer challenges):
  - Software testing
  - Treatment of Diabetes type 1
- 2023:
  - UMS Skeldar – System identification of a Skeldar helicopter

Inspiration lectures

- Carried out in collaboration with ELLIIT and the organizations for female students Yvette, Donna, and Emma.
- Topic: ”Vägen hit!”
- Speakers (most of them):
  - Charlotte Jalkebo, Scania
  - Mia Knutfelt, Saab
  - Julia Nielsen, ABB
  - Johanna Rost, Scania
  - Johanna Wallén Axehill, Saab
  - Elina Vartiainen, ABB
  - Karin Hermansson, ABB
  - Marianne Klang, Saab
  - Emma Nyström, Volvo Cars

And ….

- ….. maybe something more that we have forgot to mention.