

News

Ny ELLIIT-organisation

I samband med regeringens ökade satsning har ELLIIT sedan i augusti 2020 en ny organisation. En styrgrupp (SG) på universitetsnivå ansvarar för den övergripande planeringen och samordningen, och leds av forskningsdirektör Per Danneberg, LiU. En programgrupp (PMG) har formats som bereder förslag på forskningsprojekt och satsningar inom ELLIIT. PMG ersätter ELLIIT:s tidigare styrelse, och har, som tidigare, föreståndare Erik G. Larsson (LiU), ordförande Inger Erlander Klein (LiU), och vice ordförande och föreståndare Fredrik Tufvesson (LU).

Nya ELLIIT-projekt och rekryteringar

Ett antal nya projekt har beviljats inom ELLIIT under 2020. 22 postdoc-projekt beviljades under våren (Call A). Under hösten beviljades 14 projekt med sammanlagt 29 doktorander (Call B). Fler doktorandprojekt är utlysta (Call C) och under behandling. Arbetet med ett antal nyrekryteringar till forskar/lärartjänster har också påbörjats. Mer information om de nya projekten finns på [ELLIITs hemsida](#).

Research Highlights

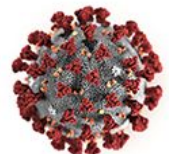
ELLIIT i kampen mot corona

ELLIIT-forskarna Kristian Soltesz (LU) och Gustaf Hendeby (LiU) har tillsammans med Fredrik Gustafsson (LiU) och Bo Bernhardsson (LU) utvecklat en hemsida som automatiskt aggregerar och visualiserar statistik över coronaläget. Sidan, www.sensorfusion.se/corona, har under året använts som diskussionsunderlag mellan gruppen och vårdplanerande epidemiologer. I början av december förstärktes gruppen med Andre Rath, förstaårsstudent på det nystartade programmet machine learning, systems and control i Lund, som börjat arbeta på en ny plattform, www.c19models.se, för att kommunicera gruppens resultat.

–Vi tycker verkligen det är roligt att inom ELLIIT-samarbetet kunna engagera såväl seniora forskare som nyblivna studenter till ett konstruktivt samarbete för att möta relevanta samhällsproblem, säger Kristian Soltesz som är docent i Reglerteknik vid Lunds universitet. Han företräder en grupp av ELLIIT-forskare vid LU och LiU, som tillsammans med kollegor från KTH, CTH, Region Skåne och Region Östergötland arbetat med modellering av coronapandemin. Ett konkret resultat av detta arbete är en modellanalys, som gruppen presenterat i ett flertal vetenskapliga sammanhang, men även för en bredare allmänhet genom bl a NyTeknik, Sveriges Radio, DN och Sydsvenskan. En sammanställning av gruppens arbete finns [här](#).

–Det finns en viktig demokratisk aspekt i att göra forskning som används som politiskt beslutsunderlag tillgänglig för en bred allmänhet, konstaterar Gustaf Hendeby.

ELLIIT >

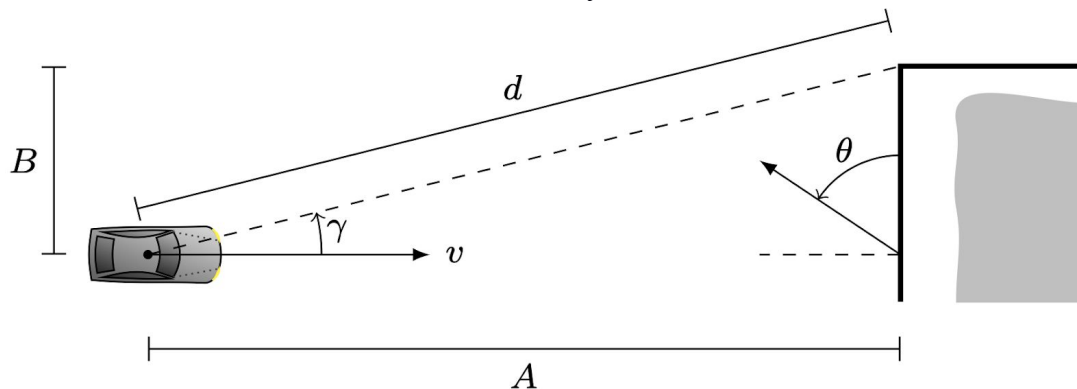


Avoiding collision when the road friction is unknown

For straight-line braking there are systems, such as the anti-lock braking system (ABS), that do not require prior information about the road friction to operate, but what about passing maneuvers? Inspired by this, Victor Fors (LiU), Björn Olofsson (LiU/LU) and Lars Nielsen (LiU) have developed such a controller for autonomous collision avoidance based on a wary strategy that assumes the least tire—road friction for which the maneuver is still feasible. Despite its modest computational time and independence of the friction, the developed controller is shown to perform well and achieve performance close to that obtained with offline numerical optimization of the control inputs. The results have been published in IEEE Transactions on Intelligent Vehicles. Link to paper:

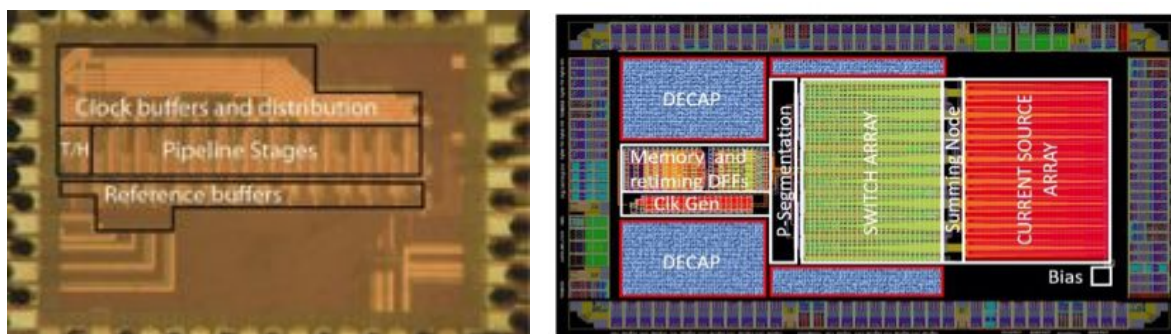
<https://doi.org/10.1109/TIV.2020.3029853>

A vehicle reacts to an obstacle a distance away from the front of the vehicle:



New high-speed energy-efficient data converters

Two high-speed energy-efficient data converters were presented at IEEE Nordic Circuits and Systems Conference (NORCAS), Oct. 27-28, 2020. PhD student Javad Bagheri (LiU) presented an inverter-based pipeline analog-to-digital converter (ADC). Fabricated in 65nm CMOS technology the ADC achieves 7.7 ENOB at 1.0 GS/s with a core power dissipation of 47.5 mW and an FoM of 0.323 pJ/conv-step. Furthermore, PhD student Oscar Morales (LiU) presented a 10-bit high-speed current-steering digital-to-analog converter (DAC) in 65-nm CMOS technology. Exploring the simplicity and scalability of binary-weighted architectures, the post-layout simulations show that the DAC achieves 3.75-GHz sampling frequency while consuming 220 mW with an energy consumption per sample of 58.6 pJ.



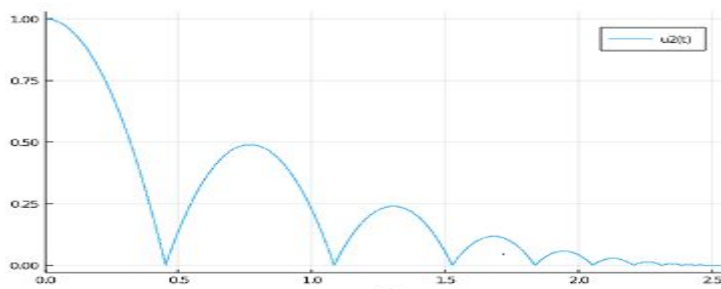
The analog-to-digital converter (left), and the digital-to-analog converter (right). For more details, see [Javad Bagheri's paper](#) and [Oscar Morale's paper](#).

OpenModelica News

OpenModelica is an Open Source Environment for Object-Oriented Equation-Based Modeling, Simulation, and Analysis of Cyber-physical systems, developed at LiU/IDA. A new release 1.16.2 of the system was published in December 2020. It includes numerous additions and improvements, and in particular, the new fast compiler frontend can now handle 100% of the Modelica Standard Library 3.2.3 models. See www.openmodelica.org

Furthermore, John Tinnerholm and Adrian Pop (both LiU) are developing a new implementation of OpenModelica, based on the Julia language. They have automatically translated the OpenModelica front-end to Julia and implemented a new backend. The prototype OpenModelica compiler in Julia can now simulate both continuous and discrete systems. The goal of the project is to support variable structured systems via Julia JIT model recompilation at runtime. The compiler will be made available to the public early next year after a testing period.

A BouncingBall simulation using the OpenModelica prototype compiler in Julia:



Mathematical modelling to investigate drug effects

Gunnar Cedersund with colleagues at LiU/IMT, used mathematical modelling to investigate the effects of an anti-inflammatory drug, Dexamethasone. The model in combination with data is used to test different hypotheses of why this drug has such a long-lasting effect, and shows that Dexamethasone has a slow release from the receptor-drug complex. This new model can be used to simulate hypothetical treatment schemes. This work opens up for a more knowledge-driven drug development, to find sustained anti-inflammatory responses and fewer side effects. See the article [Mechanisms of a sustained anti-inflammatory drug response in alveolar macrophages unraveled with mathematical modeling](#) for details.

Advances in malware analysis techniques

Ulf Kargén and Nahid Shahmehri at IDA/LiU have developed a novel method to perform dynamic analysis of malware that uses encryption to evade detection. By leveraging machine learning, their system can identify cryptographic operations and extract plaintext data directly from program traces. In another malware-related project, they studied the effectiveness of Android decompilers when applied to mobile malware, in collaboration with Saarland University. One of the main takeaways was that decompilation failures caused by obfuscation tend to be due to implementation-level limitations of decompilers, rather than by any fundamental challenges introduced by the obfuscation itself. This suggests that nearly perfect source-code recovery from malware samples would be attainable, with implementation-level improvements to decompilers.

Invited Talks

- Martina Maggio, LU/Control, held an invited talk on *Testing Adaptive Software with Probabilistic Guarantees*, at the Joint ICE-TCS/GSSI Virtual Seminars (25 November 2020)
- Elena Pagnin, LU/EIT, held an invited talk on *Exposure Notification Apps and their Security Dilemma*, at *AI, digitalisering och integritet – vad får vi för vår hälsodata?*, an event at “Lunds Universitets framtidsvecka” (October 12, 2020). [Youtube stream of the event](#).
- Prof. Andrei Gurtov, LiU/IDA, held an invited talk at IEEE R8vSYP Day 3, session 2 on *Aviation Scenarios for 5G/6G* at [IEEE R8 Student & Young Professional Congress](#).
- Prof. Simin Nadjm-Tehrani, LiU/IDA, held an invited keynote at a workshop in conjunction with the ARES (Availability, Reliability and Security) conference, in the area of Cyber Threat Intelligence Management (CyberTIM), August 2020.

Invited talks by the Integrative Systems Biology group at LiU/IMT

On October 15-16th, we had two invited talks at the digital conference Workshop on Modelling in Biology and Medicine (MBM Workshop 2020).

William Lövfors presented *Towards a comprehensive and multi-level module for metabolic control of the adipose tissue* showing how to combine small models of insulin signalling to models of the whole fat cell, using phosphoproteomics data.

Gunnar Cedersund then took it one step further and presented *Digital twins: from methods to applications*, speaking of validation, integration and usage of mechanistic, multi-level, multi-species, and multi-timescale (M4) models in health. Previous versions of these Digital Twins exist, but they all model separate organs, while in this new version, all the organs are connected through the bloodflow. By personalising these models, you can create a digital twin of the patient, which might enable both higher patient motivation for participation in the treatment, and monitoring measurements of the health of the patient during and after treatment. Such models might also be used to replace animals and improve the workflow in medical drug testing. The Digital Twins have been presented on several other occasions as well, most notably at NIH and, recently, at the VPH (Virtual Physiological Human) conference in August.

All presentations from the MBM workshop can be viewed in this video:

https://www.youtube.com/watch?v=0M2dWYwOIpq&feature=youtu.be&ab_channel=MBMWorkshop

Awards and Appointments:

- E. G. Larsson (LiU/ISY) named Highly Cited Researcher 2020 by Clarivate Web of Science (top 1% for field and year)
- Claes Wohlin from Blekinge Institute of Technology (BTH) was appointed as a board member for the Swedish Foundation for Strategic Research (SSF) in October 2020.
- Charlotta Johnsson, LiU/Control, has been appointed as [rektor for Campus Helsingborg](#) (50% of her time) for 2021-2026.

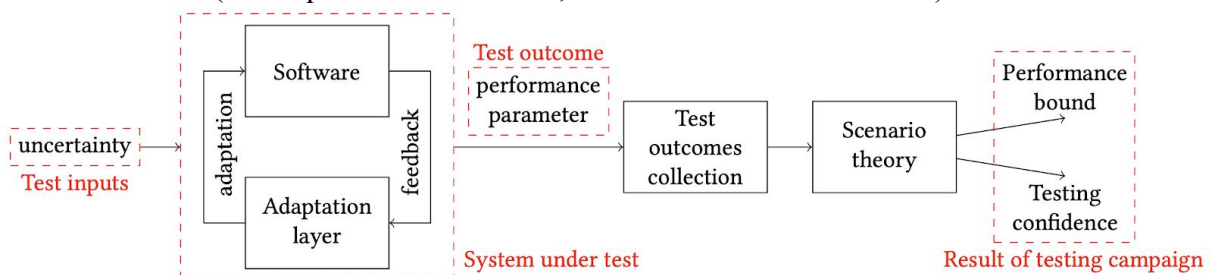
- Top rankings for BTH researchers. Among the top 441 software engineering researchers in the world, Claes Wohlin and Kai Petersen from BTH are ranked 53 and 263, respectively. The ranking is based on the citations their publications have received up to and including the year 2019. More information [here](#).
- In a ranking by Swedish magazine Fokus based on publications in scientific journals between 2010 and 2015 and citations to these articles up to and including 2017, Kai Petersen (BTH) was on number 62 among the 100 most cited researchers in the area “mathematics and technology”. More information [here](#).
- Dr. Zheng Chen (LiU/ISY/Communication systems) wins the *IEEE Communications Society Young Author Best Paper Award* for the paper [Cooperative Caching and Transmission Design in Cluster-Centric Small Cell Networks](#).
- LiU/IDA students Hanna Gustafsson and Sofie Eskilsson were the lead authors of an article *Demonstrating ADS-B And CPDLC Attacks With Software-Defined Radio* which received the *Outstanding Paper Award* at the Integrated Communications, Navigation and Surveillance (ICNS'20) Conference. The work was supervised by Prof. Andrei Gurtov within the project "Automation Program II" with Trafikverket., See <https://www.ida.liu.se/department/news/index.en.shtml>
- Fredrik Pröntare received the Best Student Paper Award at The 23rd International Conference on Principles and Practice of Multi-Agent Systems (PRIMA2020). This time for the paper "Hybrid Dynamic Programming for Simultaneous Coalition Structure Generation and Assignment" by Fredrik Pröntare and Fredrik Heintz.
- PhD student Marcus Greiff, Department of Automatic Control, LU, was awarded 2020 IEEE CCTA Best Student Paper Award for the paper *MSE-Optimal Measurement Dimension Reduction in Gaussian Filtering* by M. Greiff, A. Robertsson, and K. Berntorp.
- Harsh Tataria, LU/EIT, har tilldelats [Göran Linds pris i Tillämpad Elektronik](#) av Kungliga Fysiografiska Sällskapet
- Luke Church, LU/CS and University of Cambridge, received the [University of Cambridge annual Better Future Award](#). He received the award for his work with the Africa's Voices Foundation, a not-for-profit organisation that uses radio programs for discussions on important health and gender-related topics. Luke helped build systems to analyze text messages from the listeners to inform policymakers, governments, and NGOs. In relation to this work, Luke has had invited talks on community response mechanisms for managing Covid, e.g., [Tackling COVID-19 in Kenya and Somalia](#).
- Mattias Nordahl, Boris Magnusson, Görel Hedin, and Alfred Åkesson, LU/CS, received the *Best Demonstration Award* for the demonstration *Smart Bikes: Gradual Update of IoT Systems* at the 2020 IEEE 24th International Enterprise Distributed Object Computing Conference (EDOC). [Demo video](#).

Testing systems in the presence of adaptation

Claudio Mandrioli and Martina Maggio, LU/Control, received an *ACM SIGSOFT Distinguished Paper Award* at ESEC/FSE 2020 for the paper [Testing Self-Adaptive Software with Probabilistic Guarantees on Performance Metrics](#)

Software systems will gain the ability to change their behaviour and they will learn how to counteract specific threats. For example, a robot may learn that a given path is not traversable and will look for alternatives to reach its objective. Testing software in the presence of learning and adaptation is an extremely complex problem.

In the paper we talk about how the testing of adaptive software should switch paradigm and go from being deterministic to providing probabilistic guarantees and we argue about why it is not possible to do anything different. We use a tool called scenario theory to perform software testing for adaptive systems with probabilistic guarantees. We apply the theory to two case studies (an adaptive video encoder, and a tele-assistance service).



Program chairs and Editorships

- Emma Söderberg, LU/CS, serves as program co-chair for ACM SIGPLAN International Conference on Software Language Engineering ([SLE 2021](#)).
- Emma Söderberg, LU/CS, has been appointed Associate Editor of the [Programming Journal](#), Vol. 6.
- Peter Fritzson, LiU/IDA, is guest editor for the Electronics journal special issue on [Tools and Languages for Object-Oriented Modeling and Simulation](#), deadline January 30, 2021.
- Lena Buffoni, Adrian Pop, Lennart Ochel, Martin Sjölund, LiU/IDA are organizers of the [International Modelica Conference](#) in Linköping, Sweden, Sept 2021.
- LIU is co-organizing the [OpenModelica/MODPROD workshops](#), February 2-4, 2021.
- Wojciech Mostowski, HH, is co-organizing the 2020 [SWEDSoft Software Technology Exchange Workshop](#). The workshop was originally planned to be held in HH during 2020, but has been postponed to be held digitally in January 2021.
- E. G. Larsson co-edited a special issue on [Massive Access for 5G and Beyond](#) in the IEEE Journal on Selected Areas in Communications
- Christoph Reichenbach, LU/CS, is serving as a guest editor of the Journal of Computer Languages for a special issue on Generative Programming: Concepts and Experiences
- Prof. Simin Nadjm-Tehrani, LiU/IDA, served as program co-chair of NordSec 2020, the 25th Nordic conference on Secure IT Systems

PhD theses

- Farnaz Fotrousi (BTH) defended her Ph.D. thesis with title "Combining User Feedback and Monitoring Data to Support Evidence-based Software Evolution" in June 2020.
- Giovanni Interdonato (LiU/ISY, advisor: E. G. Larsson) successfully defended his Ph.D. thesis *Cell-Free Massive MIMO: Scalability, Signal Processing and Power Control*, Oct. 2020
- Mohammad Hassan Safavi defended his PhD thesis in Lund on the 16th of October with the title *Content and Resource Management in Edge Networks*. The thesis presented research on different optimization methods for placing content and scheduling processing in edge networks. The aim is to effectively manage resources to maximise the utility of these systems while minimizing costs such as resource usage or energy usage.
- Sebastian Sten, LiU/IMT, defended his thesis [Mathematical modeling of neurovascular coupling](#) where he presents a model of the physiological mechanisms controlling blood flow in the brain and making functional magnetic resonance imaging (fMRI), a technique used for measuring brain activity, possible. This new model-based understanding opens the door for a more integrative approach to the analysis of neuroimaging data, with potential applications in both basic science and in the clinic. The models include intracellular mechanisms, compare hypotheses of their function in the hemodynamic response, describe both increase and decrease in the brain activity, and can describe different types of measurement data. The thesis was selected as the best PhD thesis at the medical faculty at LiU for 2020.
- Marcus Thelander Andrén will defend his PhD thesis, *On LQG-Optimal Event-Based Sampling*, in Lund on Dec 17 2020.

Organized conferences and workshops

- On October 13-14th 2020, Anders Hansson (LiU) arranged together with Bo Wahlberg (KTH) the [First WASP Workshop on Large-Scale Optimization for Autonomy](#) at KTH in Stockholm.
- Luke Church was organizing chair of the workshop [HATRA](#) (Human aspects of Types and Reasoning Assistants) on Nov 18-19, at ACM SPLASH 2020.
- Luke Church, LU/CS, is General Chair of the International Conference on the Art, Science, and Engineering of Programming ([<Programming> 2021](#)).
- Prof. Simin Nadjm-Tehrani, LiU/IDA, participated in the organisation of NordSec 2020, and arranged keynote talks by Elisa Bertino (Purdue university) on 5G/IoT security as well as Marnix Dekker (ENISA) on the NIS guidelines by the European union.
- Kai Petersen (BTH) will serve as co-chair for the new ideas track at the conference on "Evaluation and Assessment in Software Engineering" EASE'21 in Trondheim, Norway, in June 2021.

Personnel

- Alexander Pisarevskiy, LU/Control, receives permanent appointment as research engineer from January 1, 2021.
- Niklas Fors, LU/CS, has been appointed associate senior lecturer (biträdande universitetslektor), from January 1, 2021.
- Luke Church, University of Cambridge, started at LU/CS as a part time adjunct lecturer in September 2020, to work on adaptive developer tools, partly as co-PI of the ELLIIT pre-project headed by Emma Söderberg.
- Ebo Bennin (a postdoc at BTH) left the ELLIIT environment at BTH in September 2020 for a position as Assistant Professor in Software Engineering at Wageningen University & Research in the Netherlands.
- Dr Ali Basirat, currently at Uppsala University, will start a postdoc position with the Natural Language Processing Group at IDA/LiU, on 1 January. Ali will be working on the design, implementation, and evaluation of an end-to-end system for relation extraction based on deep neural language models in the context of an ELLIIT pre-project headed by Associate Professor Marco Kuhlmann.
- Dr. Ioannis Avgouleas joined as a postdoc at IDA/LiU in the ELLIIT pre-project headed by Prof. Andrei Gurtov.
- Taqwa Saeed, previously at University of Cyprus, is starting as ELLIIT Postdoctoral researcher at Halmstad University from January 2021. She will work on cooperative maneuvering under the supervision of Maria Khil (Lund) and Alexey Vinel (Halmstad).
- Kenan Sehic started at LU/CS in Fall 2020 as a WASP postdoc in machine learning.
- Francesco Rovida, started at LU/CS in July 2020, to work on a WASP WALP project in autonomous robot systems.
- Ulf Kargén started as a postdoc at IDA/LiU.
- Dr. Emil Rofors, Dept of Nuclear Physics, Lund University, is joining the ELLIIT preproject *Autonomous Radiation Mapping and Isotope Composition Identification by Mobile Gamma Spectroscopy* to work on the development of a light-weight radiation sensor during spring 2021.
- Alan McCabe started at LU/CS in September 2020 as a PhD student to work on adaptive developer tools.
- Chung-Hsuan Hu, started at LiU/ISY in August 2020 as a Ph.D. student in communication systems.
- Eduardo Duarte started as PhD-student at Halmstad University in Fall 2020 and is working on cooperative emergency vehicles in collaboration with H&E Solutions.
- Carl Hvarfner started at LU/CS in Fall 2020 as a WASP Ph.D. student in machine learning.
- Leonard Papenmeier started at LU/CS in Fall 2020 as a WASP Ph.D. student in machine learning.
- Umar Iftikhar started at BTH in September 2020 as a Ph.D. student in software engineering.
- Martin Gemborn Nilsson will start as an ELLIIT-funded PhD student at LU/Control in January, to work with Bo Bernhardsson.
- Callum Kingtree will start as an ELLIIT-funded PhD student at LU/Control, likely in September, to work with Richard Pates.

Research Grants

- Forskare från LU och LIU har fått 32.5 MSEK från SSF för att bygga hårdvara för stora intelligenta ytor (Large Intelligent Surfaces).
- Dr. Zheng Chen wins CENIIT research grant for work on wireless communications architectures to support distributed and federated machine learning
- H2020-REINDEER, "REsilient INteractive applications through hyper Diversity in Energy Efficient RadioWeaves technology" granted, Nov. 2020, partners include LiU and LU, PoC: E. G. Larsson (LiU), F. Tufvesson, O. Edfors, L.V.d. Perre (LU) "The REINDEER project will develop a new smart connect-compute platform with a capacity that is scalable to quasi-infinite, and that offers perceived zero latency and interaction with an extremely high number of embedded devices."
- A5GARD, Lund/EIT a 3 year 60 MSEK CELTIC-NEXT (Vinnova) project on network self-management functions in homes to support demanding emerging applications. Partners: LTH, Telenor, Mic Nordic, Region Västerbotten, Sensative, Transtema, Adtran, BT, Enovas, GOHM, InPhoTec, Maxlinear, Skipio.
- VINNOVA FFI project EPIC "[Emergency Vehicle Traffic Light Pre-emption in Cities](#)" (2020-2022) - coordinator is H&E Solutions AB - a leader in digital solutions for special vehicles and inventor of the novel vehicle-to-vehicle communication product EVAM Transmit. Halmstad University is a research partner in the project.
- Prof. Simin Nadjm-Tehrani, LiU/IDA, was granted an extension of the national research centre on Resilient Information and Control Systems (RICS), formally as a new project financed by MSB (7.5mSEK, 2021-2023).
- Johan Bergström, Trafikflyghögskolan, har fått 1.200 tkr infrastrukturstöd från LTH till [UAV@LU](#) för att etablera en infrastruktur och ett tvärdisciplinärt centrum för obemannade flygande plattformar (UAV).

Courses, outreach

New courses at LTH/Control

Next academic year, the Department of Automatic Control LTH will offer two new advanced courses to the engineering students related to machine learning and control:

FRTN65 Modeling and Learning from Data (7.5 credits, given in study period 1–2): The course provides an introduction to the problem of learning system models from data, focusing on the basic concepts behind data analysis. The aim of the course is that students should learn principles and fundamental limitations of what can be learned from data, with techniques coming both from the machine learning and system identification domains. Course plan:

<https://kurser.lth.se/kursplaner/live/50/en/FRTN65/>

FRTN75 Learning-Based Control (7.5 credits, given in study period 3): The course provides fundamental theory and methodology for developing control laws based on measured input and output signal data. The aim of the course is that the students should learn the important principles within the area of learning-based control, and to understand their limitations.

Course plan: <https://kurser.lth.se/kursplaner/live/50/en/FRTN75/>

LTH will also offer a new course on the technology and applications of UAV systems. This course will be a 7.5 ECTS credits for engineering students and others, starting in September 2021. The course is the result of the LU cooperation project UAV@LU on unmanned vehicles and autonomous flight. The course is initially introduced as elective for three programmes: Risk Management Engineering, Disaster Risk Reduction, and Land Surveying (Lantmäteri), but may be offered to additional programmes over time.

Komprimerad robotvecka

Vid LTHs årliga robotvecka bjuds skolklasser in för att besöka robotlabbet som leds av Anders Robertsson, LTH. I år fick robotveckan reduceras på grund av coronapandemin, men kunde ändå hållas som totalt 4h [online-presentationer](#) samt ett lunchseminarium av Jacek Malec: [AI Lund lunch seminar Artificial Intelligence and Robotics](#).

Skolprogrammering med miljödata

Görel Hedin LU/CS har lett utvecklingen av [LU miljödataprogrammering](#), en hemsida för programmering med satellitbilder och annan miljödata. Målet är att skolelever ska få inblick i hur programmering kan användas för att undersöka intressanta frågor relaterade till FNs globala mål. Projektet är ett samarbete med studenter, institutionen för naturgeografi, ICOS Carbon Portal och Vattenhallen Science Center. Programmeringen görs i online-miljöer som Colab Jupyter Notebooks. Uppgifterna har pilotats på flera Science Centers och i skolor och har presenterats på flera digitala nationella evenemang. Projektet har finansierats av Rymdstyrelsen, Skolverket, och ELLIITs Gender Call. Nedan visas exempel från uppgifter. Vänster: koldioxidhalt i atmosfären ([Keelingkurvan](#)). Höger: vegetationsindexberäkningar och storleksmätning på satellitbild över branden i Kårböle 2018 ([Skogsbränder](#)).

