Joakim Nilsson

Curriculum Vitae

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Klintvägen 83, lgh 1605
97 335 Luleå
Sweden

+46 70 36 36 957
nijoakim@gmail.com
nijoakim.com

Objective

I am currently employed as a lecturer at Luleå University of Technology, where I will probably stay for the foreseeable future. However, I may be open to collaborate with you in a research project if you have a good proposal.

Summary

Interests	Semiconductor-physics, low-power analog circuits, high-frequency analog circuits, electromagnetic power transfer, high-temperature bandgap sensors, electronics for quantum computing, programming and programming language design, teaching
Publications	**First author:** 3 journal articles and 3 conference proceedings **Non-first author:** 1 journal article and 3 conference proceedings To read all my first-author publications in full, see nijoakim.com/research.

Introduction

My first exposure to engineering was probably when I became an ignorant, self-taught programmer who wanted to learn how to make computer games at the age of 13 or so. On top of my excitement for computers, I had always been curious about how the universe worked and found my studies of the natural sciences to be tremendously exciting. I continued my programming hobby throughout high school, but it wasn't until I enrolled in the Engineering Physics and Electronics program at Luleå University of Technology (LTU) that my true love for science became apparent. Finally I was learning things such as the inner workings of the amplifiers in a sound system, how certain guitar playing techniques affect the harmonic content the sound being played, or how the weirdness of quantum mechanics makes our computers compute. From then on, I have been overwhelmed with how many thrilling aspects there are about pretty much every field, and how small the fraction of that is that I will have time to learn, be fascinated by, and play with during the course of a lifetime.

Having graduated from LTU with a MSc, I pursued a PhD at the very same place which has provided me with the intensely exciting opportunity to teach what I learn to both colleagues and students, as well as to learn from many very talented colleagues. In the later years, I have specialized mainly on engineering electronics, inventing integrated circuits for low-power temperature sensors which harvest energy from radio waves by utilizing millimeter-size chip coils whose geometries are very important for the power transfer efficiency. However, I feel that my knowledge about physics and the mysteries of the universe are just barely keeping up with my engineering skills. Therefore I would like to be involved in research projects in which I can develop my current skill-set, but also to transcend towards the physical aspects of semiconductors rather than merely puzzling them together in a circuit. If a potential collaboration also allows me to dive in into the field of microwave engineering, that would be a huge plus.

Skills

Electronics	I have designed and evaluated a sub-15 μW, non-SOI IC bandgap temperature sensor operating up to 230 °C [8], a sensor made possible through a thorough understanding of semiconductor physics at elevated temperatures. I have experience with integrated and discrete circuits up to 500 MHz, in particular integrated circuit coil design for inductive links between PCB coils and chip coils [9]. I have designed two IC chips with Cadence Virtuoso in 350 and 180 nm. I have experience with electromagnetic simulations using FEKO. For SPICE simulations I have been using OrCAD PSpice, Cadence Spectre, LTspice, and Gnucap. I also have limited hobby-experience using GNU Archimedes for semiconductor device simulations.
Computer skills	I have been a hobbyist programmer since the age of 13. I maintain and develop the Python electronics library and utility, EPPP (github.com/nijoakim/eppp). Python is my go-to language, but I also have experience with C, C++, Java, Scala, Haskell, Prolog and MATLAB. I am a GNU/Linux enthusiast and a fanatic Vim user. I have experience programming embedded microcontrollers and FPGAs. I have experience with Microsoft's Office suite.
Teaching	I have been involved in several university courses both as a lab-tutor and as the primary lecturer. All courses I was involved with have gotten excellent course evaluations which are available upon request.
General skills	I have strong analytical and mathematical skills [12]. I have an IQ of 135 or more according to an IQ test organized by Mensa (FRT form A). I have broad knowledge of physics and various aspects of engineering, and I have basic skills in chemistry. I am used to working in a lab environment and I have a curiosity to understand the instruments I am working with. I am cooperative and often willing to discuss compromises when I disagree.
Languages	I am fluent in Swedish (mother tongue) and English and I speak a little French. I write well and prefer LaTeX for both writing and presentations.
Misc.	European driver's license (category B)

Education

2014–2019	**PhD in Industrial Electronics, Luleå University of Technology**
2008–2013	MSc in Engineering Physics and Electrical Engineering, Luleå University of Technology
2005–2008	Science Program, Strömbackaskolan, Piteå

Work Experience

2021-present	**Lecturer at Luleå University of Technology** Involved in the following courses:

- **Electronics** (E0007E), year 2021:

  - Primary lecturer and examiner: Lectures on diodes, BJTs, MOS-FETs, op-amps, semiconductor physics, voltage regulators, basic amplifier circuits and CMOS logical circuits.

- **Circuit Theory** (E0003E), year 2020:

  - Primary lecturer and examiner: Lectures on basic component knowledge, electric circuit fundamentals and analysis methods, passive and active filters.

- **Real Time Systems** (D0003E), year 2021:

  - Primary lab tutor: Concurrent programming for real-time kernels for embedded systems.

- **Declarative Languages** (D7012E), year 2021:

  - Primary lab tutor: Functional and logical programming in Haskell and Prolog.

2019-2020 | **Senior research engineer at Luleå University of Technology**
Research in integrated circuit design for radiation detectors for gold detection in ore in the Vinnova-funded 'SMuL' project. The work mostly includes design and testing of an IC charge amplifier in simulation and in the lab.

Involved in the following courses:

- **Electronics** (E0007E), year 2020:
    - Primary lab tutor: SPICE simulations and labs on op-amps, voltage regulators and basic amplifiers.
    - Lecturer: Lectures on MOSFET fundamentals as well as example exam assignments.
    - Design and grading of exams.

- **Electronic Systems** (E7030E), year 2019:
    - Lecturer: Lectures on Analog-to-Digital and Digital-to-Analog converters.

- **Fundamentals of Electrical Engineering** (E0013E), year 2019:
    - Primary lab tutor: SPICE simulations of basic electronic circuits.

- **Real Time Systems** (D0003E), year 2020:
    - Primary lab tutor: Concurrent programming for real-time kernels for embedded systems.

- **Declarative Languages** (D7012E), year 2020:
    - Primary lab tutor: Functional and logical programming in Haskell and Prolog.

2014–2019 **PhD student at Luleå University of Technology**
Research in wireless, low-power, high-temperature sensors for monitoring of power semiconductors. The main research outcomes are:

- IC coil geometries optimized for light loads and high power transfer effiency [9] with measurements on manufactured ICs;

- Design methodology for maximal Q factor for IC fuse-trimmable capacitors [12]; and

- A low-power, high-temperature IC temperature sensor [8].

Responsible for the microelectronics lab, making sure that equipment and components are available and that instruments work, in particular the Delvotec 5410 wedge bonder.

Involved in the following courses:

- **Electronic Design** (E7009E), years 2016 and 2017:
  - Primary lecturer: Lectures on SPICE simulators, noise, distortion, feedback, audio amplifiers, heat, reliability, DC–DC converters, ADCs and DACs.
  - Primary lab tutor: SPICE simulations and labs with the objective of constructing an audio amplifier.

- **Electronics II** (E7014E), year 2016:
  - Primary lab tutor: SPICE simulations and labs on differential amplifiers, cascodes, filters, oscillators and high-frequency circuits.
  - Lecturer: Lecture on multivibrators.

- **Electronics** (E0007E), years 2013, 2014, 2015, 2016:
  - Primary lab tutor: SPICE simulations and labs on op-amps, voltage regulators and basic amplifiers.
  - Lecturer: Lectures on MOSFET fundamentals as well as example exam assignments.

2013 **Research engineer at Luleå University of Technology**
Code optimization and data visualization for the 'EISCAT' EU project, with the goal of developing antenna arrays for stratosphere radar applications. The main part of the code optimization was rewriting MATLAB code into C code in order to speed it up.

Lab tutor in **Circuit Theory** (E0003E), teaching in SPICE simulations of basic electric circuits.

2013	**Summer intern at Luleå University of Technology** Programming Internet-enabled wireless sensor nodes for the 'I^{2}Mine' EU project. The sensor nodes are placed onto rock bolts in mines to issue warning signals of when a cavity may be about to collapse.
2012–2013	**Lab tutor at Luleå University of Technology** Tutoring the following courses: **Digital Design** (D0011E), year 2013: - Digital design in VHDL with the final project being a simple MIPS processor design. **Object Oriented Programming and Design** (D0010E), year 2013: - Object oriented programming in Java. **Microcomputer Engineering** (D0013E), year 2012: - MIPS assembly programming.
2010–2012	**Summer intern at SCA Packaging, Munksund** Testing and maintenance of the fire protection and ventilation systems.
2008	**Summer intern at Kappa Kraftliner, Piteå** Conducting analysis of different liquids in a paper production process in order to determine concentrations of certain substances.
2007, 2009	**Summer intern at Kappa Kraftliner, Piteå** Various maintenance jobs in an industrial paper production environment.
2005–2006	**Summer intern at Hifton, Hemmingsmark** Various maintenance jobs as caretaker of the Hifton premises.

Publications and Theses

2021	[13]	**Joakim Nilsson, Johan Borg, and Jonny Johansson. Load-dependent power transfer efficiency for on-chip coils.** *Analog Integrated Circuits and Signal Processing***, Jul 2021**
2020	[10]	Niklas Karvonen, Joakim Nilsson, Denis Kleyko, and Lara Lorna Jiménez. Low-power classification using FPGA—an approach based on cellular automata, neural networks, and hyperdimensional computing. In *2019 18th IEEE International Conference On Machine Learning And Applications (ICMLA)*, pages 370–375, 2019
2019	[11]	**Joakim Nilsson.** *Wireless High-Temperature Monitoring of Power Semiconductors—A Single-Chip Approach.* **Doctoral thesis, Luleå University of Technology, 2019**

2019 [12] **Joakim Nilsson, Johan Borg, and Jonny Johansson. Maximal Q factor for an on-chip, fuse-based trimmable capacitor.** *Electronics*, **8(1), 2019**

2018 [9] Joakim Nilsson, Johan Borg, and Jonny Johansson. Chip-coil design for wireless power transfer in power semiconductor modules. In *2018 2nd Conference on PhD Research in Microelectronics and Electronics Latin America (PRIME-LA)*, pages 1–4, Feb 2018

2017 [6] Niklas Karvonen, Lara Lorna Jimenez, Miguel Gomez Simon, Joakim Nilsson, Basel Kikhia, and Josef Hallberg. Classifier optimized for resource-constrained pervasive systems and energy-efficiency. *International Journal of Computational Intelligence Systems*, 10:1272–1279, 2017

2017 [7] Joakim Nilsson. *Wireless Condition Monitoring of Power Semiconductors*. Licentiate thesis, Luleå University of Technology, 2017

2017 [8] **Joakim Nilsson, Johan Borg, and Jonny Johansson. High-temperature characterisation and analysis of leakage-current-compensated, low-power bandgap temperature sensors.** *Analog Integrated Circuits and Signal Processing*, **Jun 2017**

2015 [5] Joakim Nilsson, Johan Borg, and Jonny Johansson. Single chip wireless condition monitoring of power semiconductor modules. In *Nordic Circuits and Systems Conference (NORCAS): NORCHIP International Symposium on System-on-Chip (SoC), 2015*, pages 1–4, Oct 2015

2015 [4] Joakim Nilsson, Johan Borg, and Jonny Johansson. Leakage current compensation for a 450 nW, high-temperature, bandgap temperature sensor. In *Mixed Design of Integrated Circuits Systems (MIXDES), 2015 22nd International Conference*, pages 343–347, June 2015

2014 [3] J. Eliasson, P. P. Pereira, H. Mäkitaavola, J. Delsing, J. Nilsson, and J. Gebart. A feasibility study of SOA-enabled networked rock bolts. In *Proceedings of the 2014 IEEE Emerging Technology and Factory Automation (ETFA)*, pages 1–8, Sep. 2014

2013 [2] Joakim Nilsson. Towards self-learning sensors: FPGA-based ADC front end. Master's thesis, Luleå University of Technology, 2013

2013 [1] S. M. del Campo, K. Albertsson, J. Nilsson, J. Eliasson, and F. Sandin. FPGA prototype of machine learning analog-to-feature converter for event-based succinct representation of signals. In *2013 IEEE International Workshop on Machine Learning for Signal Processing (MLSP)*, pages 1–6, Sep. 2013