Dr. Dipl.Ing. Hajrudin Besic

Innovative engineer with expertise in MEMS/NEMS development, electronics, and high-precision measurement systems. Proven leadership as CTO and researcher, delivering impactful solutions in spectroscopy and sensor technology.

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Education

TU Wien 2024
Doctorate, Electrical Engineering
Thesis: *Advanced Techniques for Resonance Frequency Monitoring in Nanomechanical Sensing: Integrative Approaches and Applications*
Grade: Excellent with distinction

TU Wien 2020
Master of Science, Biomedical Engineering
Thesis: *MEMS E-Field sensor with stabilized optical readout*
Relevant Coursework: Biomedical signals and Instrumentation, Biophysics and Imaging

TU Wien 2018
Bachelor of Science, Electrical Engineering and Information Technology
Thesis: *Implementation and Investigation of the Finite-Difference-Time-Domain Method in 2D*
Relevant Coursework: Software development, Microelectronic device simulation

Experience

CTO, Invisible-Light Labs GmbH Date (October 2022-Present)
Development of IR spectroscopy sensor systems, high precision low-noise measurement equipment.
- Transformed a research concept into a sales-ready product.
- Designed custom measurement equipment adopted by 3 industry partners, enabling new spectroscopy techniques.
- Managed a cross-functional team of 3 engineers.

Post Doctoral Researcher, TU Wien Date (December 2024-Present)
Development of NEMS sensors for infrared spectroscopy and electronic systems, including noise analysis in NEMS-based systems.
- Development of NEMS sensors for bolometric infrared applications.
- Development of precise NEMS based pressure sensor.

University assistant, TU Wien Date (May 2021-December 2024)
Development of NEMS sensors for infrared spectroscopy and electronic systems, including noise analysis in NEMS-based systems.
- Developed NEMS layouts for infrared applications.
- Developed electronics for ultra-high precision sensor applications.
- Performed control and signal processing algorythms using FPGAs, embedded C and python.
- Designed novel measurement methods for NEMS applications like self-sustaining oscillator and frequency counter.
- Implemented optimal estimation and control techniques (Kalman filter).
- Worked in the clean-room on chip fabrication.

Project assistant, TU Wien Date (October 2020-May 2021)
Development of a MEMS electric field sensor.
- Developed MEMS Electric filed sensor.
- Developed Electronics for Michelson interferometer stabilization.
- Developed high voltage electronics for ion shielding.

Printed circuit board (PCB) desiger, Tttech Date (June 2019-Sept. 2020)
Design of high level high-speed printed circuit boards.
- Designed high level high-speed PCBs for automotive, industrial and aerospace applications.
- Performed signal integrity simulations with Hyperlynx pre and post layout.
- Performed power integrity simulations with Hyperlynx.

Software engineer, Robert Bosch AG Date (August 2018-September 2018)
Development of web-based interfaces.
- Database development.
- Web frontend development.

Skills

- Electronics
- NEMS/MEMS
- Signal Processing
- Spectroscopy Systems
- Optical Systems
- Fourier Transform Infrared (FTIR) Analysis
- Control Systems
- Radio Frequency
- DSP
- System Modeling
- Oscillator design
- Embedded Software
- Python
- C/C++
- MATLAB
- Verilog
- RTOS
- Embedded Linux
- Machine Learning
- Git
- Jira
- Simulation (e.g., FEA)
- COMSOL
- SPICE
- Xpedition, OrCAD
- KiCAD, Pulsonix
- LabVIEW
- Hyperlynx
- Signal Integrity
- Power Integrity
- High-Speed PCB Design
- EMC (IEC 61000)
- Product Certification
- CE Marking
- UL Certification (UL 61010-1)
- CB Certification (IEC 61010-1)
- FCC Certification
- ISO 9001
- ISO 14001
- Measurement Equipment
- PCB Prototyping Tools
- Spectroscopy Equipment
- MS Office

Soft Skills

- Team leadership and mentorship
- Effective communication and collaboration
- Strategic problem solving
- Adaptability in dynamic environments

Patents

1. **Electrical oscillation circuit and method for driving an oscillation element**
   Hajrudin Bešić, Silvan Schmid
   https://patents.google.com/patent/WO2024216317A1/en, Pub. No.: WO2024216317A1, Date: 2024-10-10
2. **Photothermal spectroscopy method and photothermal detection element**
   Silvan Schmid, Hajrudin Bešić
   https://patents.google.com/patent/WO2025248004A1, Pub. No.: WO2025248004A1, Date: 2025-05-28

Scientific work

1. **Quantifying submicrometer atmospheric aerosol chemical composition using nanoelectromechanical Fourier transform infrared spectroscopy**, Mihnea Surdu, Radiance Calmer,

Jelena Timarac-Popović, Tatjana Penn, Niklas Luhmann, Johannes Hiesberger, Veljko Vukićević, Erine Alvino Démolis, Lionel Favre, Berkay Dönmez, Hajrudin Bešić, Kostas Kanellopoulos, Silvan Schmid, Josiane P. Lafleur, Satoshi Takahama, Julia Schmale, *Science Advances, Date:2026-04-22, Vol:12(17), Article:aeb2254*

2. **Picogram-Level Nanoplastic Analysis with Nanoelectromechanical System Fourier Transform Infrared Spectroscopy: NEMS-FTIR**, Jelena Timarac-Popović, Johannes Hiesberger, Eldira Šesto, Niklas Luhmann, Ariane Giesriegl, Hajrudin Bešić, Josiane P. Lafleur, Silvan Schmid, *ACS Nano, Date:2026-03-26, Vol:20(14), Pages:11193–11208*
3. **Optimal Sensing of Momentum Kicks with a Feedback-Controlled Nanomechanical Resonator**, Kaspar Schmerling, Hajrudin Bešić, Andreas Kugi, Silvan Schmid, Andreas Deutschmann-Olek, *Physical Review Applied, Date:2023-08-01, Vol:20(2), Pages:024023*
4. **Optimized signal estimation in nanomechanical photothermal sensing**, Hajrudin Bešić, Andreas Deutschmann-Olek, Kenan Mešić, Kostas Kanellopulos, and Silvan Schmid, *IEEE Sensors Journal, Date:2025-05-07, Vol:23(5), Pages:054016-054027*
5. **Adaptable Frequency Counter With Phase Filtering for Resonance Frequency Monitoring in Nanomechanical Sensing**, Hajrudin Bešić, Alper Demir, Veljko Vukićević, Johannes Steurer, and Silvan Schmid, *IEEE Sensors Journal, Date:2024-01-23, Vol:24(1), Pages:8094-8104*
6. **Schemes for tracking resonance frequency for micro- and nanomechanical resonators**, Hajrudin Bešić, Alper Demir, Johannes Steurer, Niklas Luhmann, and Silvan Schmid, *Physical Review Applied, Date:2023-08-01, Vol:20(2), Pages:024023*
7. **ELECTRIC FIELD SENSOR WITH STABILIZED INTERFEROMETRIC READOUT**, H. Besic, A. Kainz, M. Kahr, W. Hortschitz and F. Keplinger,, *1st International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers), 2021*

Languages

- Bosnian/Serbian/Croatian: Mother language
- English: C1
- German: C2