Reinhardt Rading

Research Associate

Helmut-Schmidt-Universität - Universität der Bundeswehr Hamburg

Donnerstrasse 25, 22763, Hamburg, Germany

Email: radingr@hsu-hh.de | Website: https://reinhardtrading.com

Professional Summary

Optical sensing researcher with expertise in distributed acoustic sensing , seismic array and advanced signal processing, gravitational wave instrumentation, optical communications and networks. Proven record in developing analytical and deploying sensing systems for environmental monitoring and Newtonian noise mitigation in lab and field environments.

Education

Ph.D. Electrical Engineering Expected 2026

Helmut-Schmidt-Universität - Universität der Bundeswehr Hamburg, Hamburg, Germany.

- Focus: Distributed acoustic sensing, Environmental Monitoring, Gravitational Wave Instrumentation, Machine Learning.

M2 Masters in Optical Networks and Photonic Systems 2022

Institut Polytechnique de Paris, Palaiseau, France.

- Thesis -**The characterization and development of an optical seismometer for the Mars Mission**- iXblue.

MSc. Communication Engineering 2021

Universita di Parma, Parma, Italy.

- Thesis - **The interplay of mode dispersion with nonlinear interference in fiber optic systems**.

Research Experience

Since 2022, I have worked as a Research Associate at the University of the Federal Armed Forces Hamburg, where I have led the development and deployment of DAS systems for environmental and seismic monitoring. I contributed significantly to Newtonian noise mitigation research for gravitational wave detectors, including LIGO and the Einstein Telescope. Since 2023, I have also served as a researcher at DESY in Hamburg, where I carried out field-scale DAS experiments for monitoring environmental variables such as wind, tides, and temperature, and benchmarked DAS performance against traditional geophones and broadband seismometers.

Research Interests

- **Distributed Acoustic Sensing (DAS)**: Development of DAS systems including digitally enhanced interferometry; applications in environmental monitoring (tides, wind,

temperature), microseismic detection, structural health monitoring, and military applications.

- **Gravitational Wave Instrumentation and Newtonian Noise Mitigation**: Use of DAS and seismic arrays for Newtonian noise cancellation in detectors like LIGO and the Einstein Telescope; sensor placement optimization and advanced noise filtering.
- **Optical Communications and Networks**: Research on high-capacity, energy-efficient optical communication systems and nonlinear Kerr mitigation; integration of sensing and communication in fiber networks.

Publications

5. **Rading, R.**, et al., (2025) "Distributed acoustic sensing for environmental monitoring, and Newtonian noise mitigation: Comparable sensitivity to seismometers," arXiv preprint arXiv:2507.13523, July 2025.
4. **Rading, R.**, Isleif. K.,(2024). Coherent and Incoherent Noise Cancellation using Distributed Optical Fiber Sensors- Submitted to IEEE Photonics Society Summer Topicals Meeting Series, July 2024.
3. **Rading, R.**, (2022). Interplay of Modal Dispersion with Nonlinear Impairments on Mode Division Multiplexed Fibers- 5th IEEE Workshop on Recent Advances in Photonics Conference, March 2022.
2. **Rading, R.**, (2021). Effects of Mode Dispersion on Cross-phase modulation on Mode Division Multiplexed Optical Fibers- Presented at Junior Wireless and Optical Communications Conference, 2021.
1. **Rading, R.**, (2021). Cost Benefit Analysis Study of Either Using Elastic or Mixed Line Rate Optical Networks: case study of American and German optical networks.

Technical Skills

- **Programming and Analysis:** Python (NumPy, SciPy, ObsPy, PyTorch), MATLAB, Bash, Git.
- **Signal Processing:** Wiener filtering, MVDR, MUSIC, PCA, EOF, semblance analysis, slant-stack, adaptive filtering.
- **Tools and Systems:** LabVIEW, COMSOL, Linux, SSH, LaTeX.
- **Experimental Techniques:** Optical interferometry, DAS setup, sensor calibration, time-synchronized seismic acquisition.

Selected Memberships

- Member, **LIGO Scientific Collaboration (LSC)**, 2023–Present
- Member, **Einstein Telescope (ET) Collaboration**, 2022–Present
- Member, **IEEE (Institute of Electrical and Electronics Engineers)**, 2015–Present