Contribution ID: **50** Type: **ORAL**

Diamond Quantum Vector Magnetometer Optimization with Machine Learning Models

Wednesday, April 1, 2026 3:05 PM (20 minutes)

Defects in semiconductors and diamond are emerging as highly efficient platforms for quantum sensing applications. Machine learning offers a powerful alternative to conventional model-based data analysis in quantum sensing, particularly for computationally intensive techniques such as continuous-wave optically detected magnetic resonance (CW-ODMR) using nitrogen-vacancy (NV) centers in diamond. Traditional extraction of magnetic field information relies on nonlinear spectral fitting, which becomes a major bottleneck for high-throughput and real-time applications. In this study, we present a machine learning–based framework for full-vector magnetic field reconstruction directly from raw CW-ODMR spectra acquired from NV-diamond ensembles. By combining fast photodiode-based ODMR detection with data-driven regression models, the proposed approach preserves the intrinsic spectral resolution of NV spin resonances while eliminating the need for iterative fitting procedures. The models are trained on datasets incorporating realistic noise, strain effects, temperature variations, and contrast fluctuations, enabling direct prediction of three-dimensional magnetic field components from single-shot spectra. This framework significantly reduces computational latency while maintaining high magnetic field sensitivity, making it well suited for real-time vector magnetometry and scalable quantum sensing platforms. Overall, our results highlight the potential of machine learning to enhance the speed, robustness, and accessibility of NV-based magnetic field sensing technologies.

Academic or Professional Status

Graduate Student

Author: OZDEN, Hamdin (Morgan State University)

Co-authors: Mr MILAS, Peker (Center for Microelectronic Education and Research, Morgan State University, Baltimore, MD); Mr USLU, Isar (Department of Computer Science, University of Maryland, College Park, MD); Mr KARATAY, Fatih (Applied Physics Laboratory, Johns Hopkins University, Laurel, MD); Mr SUJETA, Tomas (Department of Physics and Engineering Physics, Morgan State University, Baltimore, MD); Mr ANONTO, Rapsan A. (Department of Physics and Engineering Physics, Morgan State University, Baltimore, MD); Prof. OZTURK, Birol (Center for Microelectronic Education and Research, Morgan State University, Baltimore, MD)

Presenter: OZDEN, Hamdin (Morgan State University)

Session Classification: Technical Session 2

Track Classification: AI in Semiconductors