Postdoctoral Position

Development of AI-Enhanced Algorithms for Optimal Sensor Placement Towards Advanced Diagnosis

Start	: January 1, 2027, *subject to French ZRR eligibility verification and final funding confirmation*.
Duration	: 18 months
Location	: University of Lille, France
Net salary	: Approximately €2,400 per month
Application	: Cover letter, CV, and at least two recommendation letters
Contacts	: Zuqi TANG (zuqi.tang@univ-lille.fr) Abdelkader BENABOU (abdelkader.benabou@univ-lille.fr) Gang ZHENG (gang.zheng@inria.fr)

Context and objective

There is a growing need for Electrical Rotating Machines (ERM) in various applications: energy production, automotive, marine and aerospace propulsion, machine tools, medical equipment, etc. Today, in most of these applications, their reliability, efficiency, performance, energy consumption, and operational safety have become critical issues. To tackle these issues, industries are increasingly looking for smarter machines and more effective monitoring and diagnostic solutions throughout their operational lifetime. Traditional condition monitoring and fault diagnosis methods primarily rely on global measurements, such as currents, voltages, vibrations, or temperatures. While these approaches are widely used, their ability to distinguish different fault types or identify their locations can be limited, especially under varying operating conditions or in the presence of multiple faults. Local measurements of physical quantities offer promising opportunities to improve the information available on machine conditions. However, integrating sensors into electrical machines raises several challenges, particularly regarding their number, placement, and practical installation constraints. Moreover, efficiently exploiting the information provided by a limited number of sensors remains a major challenge. These issues highlight the need for advanced numerical methods to optimize sensor placement and improve the reliability and accuracy of machine diagnostics.

This postdoctoral position is associated with the CAPITAINE project under the “Electrical Energy (EE) 4.0” programme of the Hauts-de-France State-Region Planning Contract (CPER). The recruited researcher will join the OMN team at the L2EP laboratory, University of Lille, and work in close collaboration with the DEFROST team at the Inria Centre. This collaboration brings together complementary expertise in numerical modeling, artificial intelligence, advanced control, and sensor integration.

The main objective of this position is to develop advanced algorithms for optimal sensor placement, with a particular emphasis on their enhancement through artificial intelligence, to improve the reliability and accuracy of electrical machine diagnostics under various operating conditions. Building on previous work carried out by the OMN team, the research aims to maximize the information extracted from a limited number of measurements and to exploit complementary sensing strategies. The ultimate goal is to support advanced hierarchical diagnosis, enabling an initial assessment of machine conditions to be progressively refined through additional measurements when necessary.

Etablissement de votre correspondant

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Expected profile

A Ph.D. degree is required for this position. The candidate should have a strong background in numerical simulation in electrical engineering. Additional expertise in optimization, machine learning, model order reduction, or data assimilation is highly appreciated.

Recent References

M. Alahyane, Z. Tang, and A. Benabou, “Optimal Sensor Placement via Parameterized Background Data Weak Method Applied to Magnetostatic Problems Including Anisotropy,” IEEE Transactions on Magnetics, vol. 59, no. 5, pp. 1–4, May 2023.

Z. Guo, Z. Tang, and Z. Ren, “Tensor decomposition-based DEIM for model order reduction applied to nonlinear parametric electromagnetic problems”, Journal of Computational Physics, 2025.

Z. Gong, Z. Tang and A. Benabou, "Real-Virtual sensor Parameterized-Background Data-Weak method for digital twin state estimation," IEEE Transactions on Instrumentation and Measurement, vol. 74, pp. 1-11, 2025.

M. Alahyane, Z. Tang, and A. Benabou, “Optimal sensor placement for electromagnetic problems: A PBDW-based approach with position constraints,” Computers & Mathematics with Applications, vol. 212, pp. 78–97, June 2026.

Z. Tang and R. Gong, "High-dimensional non-intrusive surrogate modeling for multi-physics computation: white box tensor structure vs black box deep learning," IEEE Transactions on Magnetics, 2026.

Z. Guo and Z. Tang, “Hybrid Approach Based on Tensor Decomposition for Model Order Reduction Applied to Motor Diagnosis,” IET Science, Measurement & Technology, vol. 20, no. 1, Art. no. e70045, Jan. 2026.

Z. Tang, R. Gong, A. Benabou and G. Zheng, “A non-intrusive surrogate-based PINN framework for magnetic inverse problems: application to Halbach array permanent magnet diagnostics,” 4th IACM Digital Twins in Engineering Conference, 2027.

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