Short CV

Hajime Igarashi

He received the B.E. and M.E. degrees in electrical engineering and the Ph.D. degree in engineering from Hokkaido University, Sapporo, Japan, in 1982, 1984, and 1992, respectively. From 1995 to 1997, he worked with Prof. Arnulf Kost at the Technical University of Berlin with the support of the Humboldt Foundation.
He has been a Professor with the Graduate School of Information Science and Technology, Hokkaido University, since 2004. His research interests include computational electromagnetism, design optimization, and artificial intelligence (AI)-based design. He is the Vice President of the International Compumag Society. He is the author of "Topology Optimization and AI-based Design of Power Electronic and Electric Devices", published by Academic Press in 2024. He has published over 250 journal papers.

PhD School

Title: Open Problems in Computational Electromagnetics, Optimal Design and Machine Learning Applications

Syllabus:

For young researchers, it would be important not only to acquire the fundamentals and advanced techniques of their field, but also to be aware of the unsolved problems and difficulties in the field. This seminar discusses problems that, to the best of my knowledge, have not yet been solved in computational electromagnetics, optimal design, and machine learning applications. These open problems, discussed in [1], are summarized below. This seminar will present their extensions, detailed formulations, and concrete numerical examples for the selected topics. It is expected that through discussions with the participants of this seminar, we will be able to find clues to solve these problems and deepen our understanding of these problems. I welcome additional open questions and other comments from the participants on these open problems during the seminar.

Q1: Analytical solution valid from DC to high frequencies
Q2: Computation of local magnetic force
Q3: Computation of both eddy and displacement currents
Q4: Accuracy of semi-analytical homogenization
Q5: Modeling of soft magnetic composite considering inhomogeneity
Q6: Multiscale problems
Q7: Equivalent circuit considering both eddy and displacement currents
Q8: Modeling of magnetic hysteresis
Q9: Stochastic topology optimization with fine resolution
Q10: Explanation of machine learning predictions
Q11: Improvement of accuracy in machine learning prediction of shape-sensitive characteristics
Q12: Evaluation of machine learning predictions
Q13: Measure of data complexity for machine learning
Q14: Realization of integrated optimization

[1] H. Igarashi, Questions in Computational Electromagnetics, Newsletter of International COMPUMAG Society, vol.30, no.2, 2023