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Tutorial Proposal

TUTORIAL TITLE:

Advanced Massive Simulation and Optimization of Electrical Machines for E-mobility Segment

TUTORIAL PRESENTERS:

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BIOS OF THE PRESENTERS (150 words each):

Takashi YAMADA

Takashi Yamada was born in Tokyo, Japan on January 6, 1962. He received Ph.D degree in computational mechanics from Portsmouth University, UK. He joined JSOL Corporation in 1987 and has been leading several developments of CAE software for electrical engineering. Currently, he is CTO

at JMAG division of JSOL Corporation, Tokyo Japan. He has also been serving as a member of Investigation Committee on Electromagnetic Field Analysis for Rotating Machines of IEEJ (Institution of Electrical Engineering of Japan).

Hiroyuki SANO

Hiroyuki Sano was born in Tokyo, Japan on September 29, 1975. He received Master's degree in Earth science from the University of Tokyo, Japan. He joined JSOL Corporation in 2000 and has been working for the development of the simulation technique.

Shafigh NATEGH

Shafigh received the Ph.D. degree in electric power engineering from KTH Royal Institute of Technology, Stockholm, Sweden, in 2013. He was a Lead Designer of PM machines for marine segment with the Rolls-Royce Group, Trondheim, Norway. He continued his career as a Designer of traction motors for railway applications with Bombardier Transportation. Shafigh was an R&D Senior Engineer with E-mobility Department, ABB, and Principal Engineer with Volvo Cars. In parallel to his industrial roles, Shafigh held a position as Adjunct Associate Professor at Chalmers University of Technology. He has also been Senior Principal Engineer, and also Manager of Electric Drive Unit with Polestar, Sweden. Shafigh is currently CEO of SEDRIVE, Göteborg, Sweden. He holds a position as Vice-chair of IEEE IES Electrical Machines Technical Committee. He serves also as Associate Editor of IEEE Transaction on Industrial Electronics, and Chair/Co-chair of several electrical machine including ICEM, IECON, IEMDC, ONCON and ISIE.

ABSTRACT (200 - 300 words):

This tutorial presents advances in massive simulations and optimization of Electrical Machines for automotive segment.

First, advances in electrical machine design and topologies for automotive segment with focus on passenger cars and heavy vehicles are reviewed and presented. Considering the new developments toward sustainable e-mobility, the need for more advanced simulation and optimization methods are highlighted and discussed.

In the second stage of the presentation, 3D electromagnetic finite element simulation technologies are elaborated and then a comparison between measurement results and simulations are presented, where the need for moving to 3D simulation in case of virtual prototyping is discussed. Additionally, the need for taking into account thermal and mechanical effects for a more representation of physics is detailed. This part of the tutorial is also combined with comparison with extensive measurements in order to provide a better picture on the accuracy of the developed simulation methodology.

In the third stage of the presentation, focus is placed on 3D optimization of innovative electrical machines. The optimization process is reviewed where optimization targets are set for development of efficient and sustainable product. Then, two example case studies for axial flux and innovative radial flux machines are presented and detailed. It is shown that for a proper optimization process of innovative electrical machine solutions, a move from 2D to 3D and massive simulation is necessary.

In the last stage of the tutorial, future development in simulation methods for electrical machines supported by developments in hardware are reviewed and discussed.

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