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ICEM'2022 TUTORIAL

TUTORIAL NAME: Magnetic noise control of e-machines: best practices for electrical engineers

TUTORIAL PRESENTERS (Full Names, affiliations and e-mails) ***(Max 2)*****:**
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BIOS OF THE PRESENTERS (max 150 words each):
J. Le Besnerais is the founder, CEO and CTO of EOMYS Engineering. Following a M.Sc. specialized in Applied Mathematics (Ecole Centrale Paris, France) in 2005, he made an industrial PhD thesis in Electrical Engineering at the L2EP laboratory of the Ecole Centrale de Lille, North of France, on the reduction of electromagnetic noise and vibrations in traction induction machines with ALSTOM Transport. He worked from 2008 to 2013 as an R&D engineer in the railway and wind industries on some multiphysic design and optimization tasks (heat transfer, NVH, electromagnetics, structural mechanics and aerodynamics). In 2013, he founded the engineering consulting company EOMYS. With an experience covering more than 150 projects in all application fields, EOMYS has developed a strong expertise in the analysis and reduction of acoustic noise and vibrations due to electromagnetic excitations at all design stages. EOMYS offers both testing and simulation services based on Manatee e-NVH software.

ABSTRACT (max 200 words):
This tutorial first recalls the causal chain of electromagnetic noise generation, from electromagnetic field to sound pressure field, focusing on acoustic noise due to stator yoke vibrations in Permanent Magnet Synchronous Machines. The most influential electromagnetic design variables on magnetic force harmonics are then reviewed (e.g. slot/pole combination, winding, pole shape, slot opening) as well as the main noise control techniques to be applied after prototyping (e.g. skewing, notching)

For each technique, the theoretical optimal design values are provided when possible, and a numerical simulation is run to illustrate the effect of the design variations on magnetic noise, average electromagnetic torque and torque ripple. Examples will be applied on a 48s8p IPMSM used for automotive traction application under Manatee e-NVH software.

Finally, the different techniques are ranked according to their influence on magnetic noise, providing guidance to electrical engineers at concept design stage of electric machines.

Do not forget to attach one photo of each presenter to this document