

Tutorial-6: Sunday, 23rd August 2020, 12:00-14:30 CET.



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Magnetic Noise and Vibration in Main EV HEV Electric Motor Topologies

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Tutorial Abstract:

Electromagnetically-excited noise and vibrations (e-NVH) can drive the vibroacoustic signature of electric motors used in e-mobility applications. Tackling noise issues after manufacturing can be particularly expensive and may degrade e-powertrain overall performances (efficiency, cooling, weight). Electric motor designers now have taken into account e-NVH phenomena at early design stage, besides usual electromagnetic and thermal aspects.

This tutorial first presents noise sources in electric powertrains, including slotting and switching excitation sources. The physical process of air-borne and structure-borne magnetic noise generation is detailed, from current to sound pressure level, including resonance phenomena. It is shown that it is particularly important to identify main magnetic force wavenumbers and frequencies during early electromagnetic design stage of electrical machines.

Therefore, the analytic characterization of magnetic forces in two key EV HEV topologies is carried, namely Interior Permanent Magnet Synchronous Machines (Tesla model 3) and Squirrel Cage Induction Machines (Audi e-Tron). Differences in electromagnetic excitations is discussed and illustrated with spectrograms obtained using MANATEE[®] software multiphysic simulation tool.

Biography:



Dr. J. LE BESNERAIS 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 machines with ALSTOM Transport. After working as an engineer in the railway and wind turbine industries, he created EOMYS ENGINEERING in 2013, a company providing applied research and development services in electrical engineering.

EOMYS has developed a strong expertise in the analysis and reduction of noise and vibrations due to electromagnetic forces in rotating machines. The company has worked on both synchronous and induction machines, from W to MW range, obtaining up to 40 dB reduction after redesign. Based on its consulting experience, EOMYS has developed MANATEE (Magnetic Acoustic Noise Analysis Tool for Electrical Engineering), the first simulation software for the fast calculation of variable speed noise and vibrations due to magnetic forces.