EMC Distinguished Lecture

Dr. Robert Kebel

Expert in EMC and Lightning Protection, AIRBUS, Hamburg, Germany

"Conducted EMI of an Inverter-Driven Electric Power Train"

Date: 26th Jul. 2022 **Time:** 14:00 -16:30 (CEST)

Onsite location: Shared Facility Center HTSP (Room: Escher)

Haaksbergerstraat 65, 7554 PA Hengelo, Netherlands

Online Link : Zoom Meeting (ID: 321 233 9859 Passcode: 463240)

https://tuhh.zoom.us/j/3212339859?pwd=RzVsdVBHdHVRY0hRMlNWdXNRaHVmUT09

IEEE BENELUX EMC Chapter (Host)
Contact person for onsite issues
Mr. Pavithrakrishnan Radhakrishnan
Department of Electrical Engineering ESAT-WaveCore
KU Leuven | Bruges Campus
Spoorwegstraat 12, B-8200 Brugge, BELGIUM
Tel: +32 494 93 92 28
E-Mail: pavithrakrishnan.radhakrishnan@kuleuven.be
WWW: iiw.kuleuven.be/brugge/m-group

IEEE German EMC Chapter (Co-host)
Contact person for online issues
Dr. Cheng Yang
Institut für Theoretische Elektrotechnik
Hamburg University of Technology (TUHH)
Blohmstr. 15, 21079 Hamburg
Tel: +49 40 42878 2173
E-Mail: cheng.yang@tuhh.de
WWW: www.tet.tuhh.de

Note: due to a limted capacity onsite, if you prefer attending the event in person, please **sign up in advance** by sending email to pavithrakrishnan.radhakrishnan@kuleuven.be, otherwise, please join the meeting online and free to sign up (cheng.yang@tuhh.de)

EMC Distinguished Lecture by Dr. Robert Kebel

Conducted EMI of an Inverter-Driven Electric Power Train

Abstract: Due to the electrification in mobility applications, electric (high) power trains become an increasingly important subject of investigating EMI. This talk provides an overview about the systematic root cause of electromagnetic conducted emissions of a power train. Direct current (DC) power sources such as batteries or fuel cells provide the energy for propulsion. Alternating current (AC) electric engines drive the vehicle, because AC engines have advantages in maintenance and reliability. Pulse-width modulating (PWM) inverters convert DC into AC voltages. PWM technology can lead to significant electromagnetic interference (EMI) issues pending e.g. on power level and more electric parameters, which should be chosen early for mitigating the EMI risk. A simple predictive simulation model supports making integration decisions in view of the EMI risk.
Typical power levels for smaller aircraft power trains start at 100 kW; levels up to some 10 MW are necessary for the propulsion of large transport aircraft. Fast switching inverters converting high power levels imply a high dV/dt and a significant EMI potential in common mode (CM). This talk will also show how the choice of the inverter and the choice of the power system (IT versus TN network) limits or exacerbates interference. Crosstalk to wiring looms routed adjacently to power train AC cables will further illustrate the effects and provide options for an optimization of a power train from an EMI point of view.

Biography: Dr. Robert Kebel received the Diploma in electrical engineering from Hanover University (now Leibniz University of Hanover), Hanover, Germany, in 1995, and the Ph.D. degree in 1999. After receiving his diploma, Robert joined the research group of Professor Heyno Garbe at the University's Institute for Basic Electromagnetics and Measurement Technology where he was a research assistant. In 1996, Dr. Kebel became a research assistant and was employed by the German Armed Forces University in Hamburg, now Helmut-Schmidt University Hamburg. He lectured on EMC training classes, EMC consulting, and professional EMC training for industrial partners, and also contributed to the European European Community Action Scheme for the Mobility of University Students (ERASMUS) student exchange program. He conducted the research program "absorption of electromagnetic energy," and investigated the interaction of temperature fields and electromagnetic fields with temperature variable material properties with numerical and analytical methods and by measurement. He prepared an EMC test laboratory for accreditation according to the relevant quality standard EN 45001, in 1997 and 1998, respectively. He then joined the European Aeronautic Defence and Space Company (EADS) military aircraft section in Bremen and worked on the field of signature technology. In August 2001, he joined Airbus in Hamburg, where his duties and responsibilities were within the EMC of aircraft electronics, including Hamburg-engineered systems integrated into the Airbus fleet. Soon he became the focal point for the EMC assessment of wireless cabin services. Dr. Kebel is an IEEE Senior Member and is a world-renowned expert in EMC and lightning protection. He has been involved in various tasks for integrating electric and electronic systems into aircraft and has studied root-cause and impact of environmental electromagnetic factors on aircraft electric power systems.