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Dr. Dinesh Kumar is a senior member of IEEE and the senior power electronics expert at Global R&D Center of Danfoss Drives, Denmark. He received his Master's in Power System Engineering from Indian Institute of Technology (IIT), Roorkee, India in 2004 and PhD in Power Electronics from University of Nottingham, UK in 2010.

He has over 20 years of experience in academia, industry and international standardization committees with extensive technical competence in power electronics and power quality. He is an active member of IEC SC77A, TC22/SC22G, SyC LVDC nominated by Danish national standardization committee. With this, he is an Adjunct Associate Professor with School of Electrical Engineering and Robotics, Faculty of Engineering, Queensland University of Technology, Australia.

From 2004-2005, he served as a Lecturer in the Electrical Engineering Department at National Institute of Technology, Kurukshetra, India. In 2006, he joined Technical University Chemnitz, Germany as a Research Fellow in Power Electronics. Since 2011, he has been with Danfoss Drives A/S, Denmark, where he is involved in many research and industrial projects, including Multiphysics simulation and advancement in tool development. His current research interests include design of motor drive system, harmonic analysis and mitigation techniques, power quality and electromagnetic interference in power electronics. Dr. Kumar is an active contributor and supervisor/collaborator of PhD students in various universities such as Aalborg University, University of Queensland, Queensland University of Technology and IIT Madras.

Dr. Kumar is the Editor-in-Chief of International Journal of Power Electronics and the Associate Editor of IEEE Transaction on Industry Applications (SECSC and IDC), and member of Editorial board of IEEE Transportation Electrification eNewsletter.

Dr. Kumar has published over 75 journal and conference papers, holds one patent granted and four patent application pending. He has received multiple best paper awards from IEEE Transaction & conferences.

Proposed Lectures Abstract

1. **Harmonic challenges in Existing and Future Grids: Reflection from International Harmonic Standardizations**

   The recent development in power electronic devices have increased the use of converters in renewable energy sources (RES), energy storage systems and smart loads in various industrial, commercial, and residential applications. These modern power converter technologies with fast switching semiconductor devices give harmonic distortion in a higher frequency range, where existing IEC and IEEE standards have requirement gaps. To ensure the seamless and fast transition to green energy technologies such as RES (solar, electric vehicles etc.), the main challenge is how the gaps in the relevant standards need to be identified and how to be addressed. The lecture will focus on such challenges and its resolutions.
   The main aim of this lecture includes but is not limited to:
   - Harmonic and inter-harmonic standards and recommended practices.
   - New power quality disturbances monitoring (based on field data).
   - Immunity issues of power electronic equipment in distribution networks.
   - Gaps in the existing IEC and IEEE standards.
   - Updates from relevant IEC and IEEE working groups about revision of existing standards and new developments.

2. **Supra-Harmonics (2-150kHz) analysis of grid connected power electronic converters in distribution networks.**

   Increasing penetration of modern power electronic technologies with fast switching semiconductor devices (such as MOSFETs and IGBTs) has introduced power quality issues, which are shifting from the low-frequency range of 0–2 kHz to the new frequency range especially waveform distortion above 2 kHz. This new frequency range waveform distortion led to fast transients, which can cause failures in grid communication, degradation of equipment’s, such as distribution transformers, malfunction of smart energy meter, and system protection faults. This can further accelerate the challenges in the measurement of voltage and current as well as in maintaining the requirements of the electricity codes and contractual obligations between network operators and the users.
   The main aim of this lecture will be:
   - Source of high frequency distortion in distribution networks.
   - Status and trend of high frequency distortion in distribution networks (based on field data).
   - Interaction of modern power converters with grid and other equipment at the point of common coupling, recently reported immunity issues.
   - Modeling and simulation challenges, multi-physics simulation approach.
   - Measurement methods.

3. Electro-thermal modeling of capacitor design for power electronic converters.

The capacitor is one of the important components for DC-link filtering of power electronic converters. The DC-link capacitors are reliability critical and highly affected by the aging effect, therefore capacitors are one of decisive components for converters' lifetime. The criteria to size the DC-link filter are mainly from the aspects of stability and power quality. Nevertheless, the reliability of the DC-link filter is also an essential performance factor to be considered, which depends on both the component level inherent capability and the operational conditions (e.g., electro-thermal stresses) in the field operation. During converters' design, the life-time prediction and benchmarking of the DC-link capacitor is normally done by considering specific product operation. However, in typical applications, the converter is not working alone, which is connected in parallel with other equipment/converters with a distribution network. The interactions between the power grid and multiple converters create multiple resonance phenomena and different harmonic spectrum at the DC-link, which should be considered in the concept and design phase of a converter.

The main aim of this lecture will be:

- To analyze the effect of power quality disturbances on DC-link capacitors.
- Existing power quality indices and why they are not the right indicator to assess the effects on DC-link capacitors.
- Proposal for new power quality indices for reliability study.
- Life-time prediction at a product level versus system level.
- Modern design methodology for DC-link filter.