

Lecture:

ROTOR DYNAMICS OF ELECTRIC MACHINES



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ABSTRACT

Rotordynamics deals with the dynamic behavior of rotating machines. The operation should be free of troubles or disturbances. It represents a special branch of mechanical vibration theory, focusing on rotating systems and phenomena. Analysis tools include computational tools, modeling (FEM) and measurements. Electromagnetic interaction (unbalanced magnetic pull, UMP, torque harmonics, etc.) and rotor designs (laminated rotors, permanent magnet rotors, squirrel cages, etc.) are considered as special areas of rotor dynamics of electrical machines. Rolling element bearings also represent an important component for understanding the dynamic behavior of electrical machines, so the basic principles of their modeling are presented in this lecture. The presentation of a case study, "Hermetic Steam Turbine Generator for waste heat recovery - HERGE concludes this lecture.

BIOGRAPHY

Jussi Sopanen received his M. Sc. Degree in mechanical engineering and D. Sc. (Technology) degree from Lappeenranta University of Technology (LUT), Lappeenranta, Finland, in 1999 and 2004, respectively. He has been a researcher in the Department of Mechanical Engineering at LUT in 1999-2006. He worked as a product development engineer in electric machine manufacturer Rotatek Finland Ltd. in 2004-2005. During 2006-12 he worked as Principal Lecturer in Mechanical Engineering and Research Manager in the Faculty of Technology in Saimaa University of Applied Sciences, Lappeenranta, Finland. Since 2012, he has been a Professor in Machine Dynamics in the Department of Mechanical Engineering at LUT. Up to date, he has supervised 12 doctoral dissertations and 42 Master's thesis. His research activities include rotordynamics of high-speed electrical drives, mechanical design and analysis of electrical machines, real-time multi-body simulation and digital twins of dynamical systems. He is the Director of INERCOM – Integrated Energy Conversion Machinery – LUT research platform. He has published over 110 refereed journal and conference articles in the field of dynamic system design and simulation. He is a member of the editorial board in Shock and Vibration –journal and has acted as a reviewer for 36 scientific journals. He is member of IFTToMM TC Rotordynamics. Currently he is serving as National Chair for Finland's Member Organization of IFTToMM.