Invited Talk by Dr. Ashok Kaushal

Dr. Ashok Kaushal, Affiliate Associate Professor, Concordia University, Montréal, Québec, Canada and Senior Specialist Engineer-Technical Lead, Rolls-Royce Canada (RRC), Dorval, Québec, Canada delivered an invited talk to students and faculty of The LNMIIT on December 27, 2013 from 11:00 pm to 1:00 pm in LT- 9. The topic of the talk was "**Dynamic Analysis of a Variable Speed Industrial Gas Turbine Engine & Drive-train Analysis and Testing**".

Profile of Dr. Ashok Kaushal

Dr. Ashok Kaushal completed his Masters and Ph.D. from Concordia University in 1985 and 1992. His Master thesis and Ph.D. was on "Dynamic Analysis of Rotating Structures" and "Comprehensive Dynamic Analysis of a Bladed Disk-Turbo rotor-Bearing System". During his Masters study, some of the courses was taken include: Computer Aided Design, Finite Element Analysis, Optimum Design of Mechanical Systems, Stress Analysis, Numerical Methods, Random Vibrations, Advanced Dynamics, Modal Analysis of Mechanical Systems, and Vibration Problems in Rotating Machinery. Presently he works as an Affiliate Assistant Professor in Concordia University since 2012 and takes courses: Concurrent Engineering in Aerospace Systems; Dynamic Analysis of Mechanical Systems for graduate students and courses: Statics, Dynamics, Technical Drawing, Instrumentation and Measurement, Computer Aided Mechanical Design, Design and Analysis of Mechanical Structures, Engineering Mathematics and Numerical Methods for under graduate students. Before this, he worked as an Assistant Professor in Ryerson University, Toronto, Ontario, Canada where he conducted research in the area of dynamic analysis of rotating structures. A complete finite element model including the coupling behavior between all the components of a turbo rotor system was developed using the finite element package ANSYS. A complete investigation of the aircraft turbo rotor system studying the vibration behavior under free and forced conditions along with stress analysis was initiated. An experimental setup to validate the analytical results was also being developed. Produced Mathematical/Finite Element modeling, design and analysis of various mechanical structures; Conducted experimental validation of analytical investigations from Sept.1998 – Aug.2000.

Submitted by Mr. Prabin Kumar Jha, Assistant Professor, Dept. of Mechanical-Mechatronics Engineering

In addition to these, Dr. Kaushal works as Senior Specialist Engineer-Technical Lead in Rolls-Royce Canada (RRC) and his key areas: Technical Authority for Vibrations and Testing. Responsible for the planning, resourcing, supervision and technical quality of component modeling, analysis and validation activities within the Rolls-Royce Energy Business (U.S.A, U.K and Canada). He is an active member of the corporate Global Methods Council(s), regularly attending face to face conferences and interacting with colleagues from other Rolls-Royce sites, participating in the development and implementation of corporate analysis strategies and methods. Review data and drawings for compliance with gas turbine engine standards. Perform/Supervise mechanical design and analysis of the gas turbine engine components. Define validation requirements (components and total system) for vibration analysis, interpret test data in correlation with the analysis and support validation of the definition. Determine engine and component test requirements and analyze data from engine running. Deliver system synthesis of the whole turbine (dynamics and interface) and the analysis of design behaviors over the gas turbines operating range. Define relevant rig and engine tests to be done and liaise with the development group for test preparation. Interpret test data and issue reports for the purpose of validating the design. Perform modal analysis of development components. He published over 17 technical papers, two reports and he has supervised 01 PhD and 02 Masters students. He contributes as an expert member of scientific committees, and reviewer of Sustainable Development Technology Canada (STDC) Ottawa, Ontario.

Abstract of talk:

Dr. Kaushal introduced the profile of the Rolls Royces company which is mainly in Gas Turbine business and then spoke on the structural integrity of a gas turbine engine with its rotating parts and drive-train. The structural integrity depends upon the ability to predict the dynamic behavior accurately and meet the design requirements to withstand steady and vibratory stresses. The dynamic model of the engine should be as fully representative as possible and include all rotating and static components and allow for the coupling between the various rotating systems through casings, inter-shaft bearings and drive-train couplings. He explained the accurate and reliable analysis of the rotor dynamic behavior is therefore essential and requires complex and sophisticated modeling of the engine spools rotating at different speeds, static structures like casings and frames, elastic connections simulating bearings and modeling the full drive-train. Furthermore, he also focused on a finite element model of the Trent Mechanical Drive (TMD) engine including the drive-train components, such as the couplings, compressor and gearbox has been developed and tested at Rolls-Royce Canada. Due to the complexity of the engine structure the model has been divided into several substructures modeled separately. Such a division facilitates the implementation of any design changes to the engine and the drive-train. He pointed out the engine vibration tests were also conducted to validate the analytical models, in particular to ensure that the vibration levels are acceptable while dwelling at a predicted critical speed. Also, to ensure that these vibration levels are acceptable due to change in unbalance characteristics, additional out of balance was introduced at the power turbine take off hub (PTO).