2008-2009

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Teik C. Lim, Ph.D., P.E., Fellow(ASME, SAE)
Professor and Department Head of Mechanical Engineering
University of Cincinnati

Professor Teik C. Lim is a member of the Mechanical Engineering faculty at the University of Cincinnati, and is currently the Department Head. Previously, Professor Lim had held faculty appointments at both the University of Alabama and the Ohio State University. His industrial experience is fairly extensive. He was employed by the Structural Dynamics Research Corporation and also served as consultant to numerous companies including Ford, GM, Scania, and Caterpillar. Professor Lim's research interest is in power transmission systems, structural dynamics, vibro-acoustics, sound quality and active control. His work has been funded extensively by the NSF, the Army Research Office, National Institute of Health, and industrial companies/research centers. Specifically, Professor Lim has contributed significantly to the dynamic analysis and development of precision machine elements including gears, bearings and drivetrains with applications to automotive, aerospace and manufacturing systems. He has published 130 technical papers, many of them on his pioneering research work in 3-dimensional gearing dynamics, active noise and vibration control, and vehicle structural dynamics. Professor Lim is a Fellow of the American Society of Mechanical Engineers (ASME) and the Society of Automotive Engineers (SAE). He is an outstanding engineering educator, and was presented with numerous honors including the SAE Ralph R. Teetor Educational Award, and the ASEE Ferdinand Beer and Russell Johnston Jr. Outstanding Mechanics Educator Award. Professor Lim has served as an Associate Technical Editor for the ASME Journal of Mechanical Design, and is a member of the Editorial Board for the International Journal of Vehicle Noise and Vibration. Recently, Professor Lim was awarded the prestigious Chang Jiang Chair Professorship by the China's Ministry of Education to serve as an academic and research advisor to Chongqing University and to direct a research team in the State Key Laboratory of Mechanical Transmissions. Professor Lim received his B.Sc (1985), M.Sc (1986) and Ph.D. (1989) degrees in Mechanical Engineering from the Michigan Technological University, University of Missouri-Rolla and Ohio State University, respectively.

Thursday, Oct. 2, 2008 3:00 - 4:00 p.m. Room 112, ME-EM Bldg.

Modeling, Analysis and Control of High-Speed Gear Dynamics

Gear dynamics is one of the most critical factors affecting the noise (whine), vibration and durability performances of gearbox, drivetrain and power transmission systems. In fact, the dynamics of a gear pair is vital to today's automobile NVH (noise, vibration and harshness) performance that drives the competitiveness of this product. The source of the transmission error excitation emanates from the sensitivity of the gear pair to its tooth profile errors, shaft misalignment, and the overall structural dynamics. The resulting vibratory response can be very complex and difficult to control due to the strong coupling between the gear pair and its supporting structures. Therefore, gaining a more thorough understanding of the underlying physics governing the gear pair dynamics is essential in the design and development of quieter and more durable geared rotor systems. The initial part of this presentation will focus on the dynamic modeling of gear pairs that covers the various gear mesh models presently applied. The discussion then moves on to a class of harmful out-of-phase gear pair torsion modes that have been theorized as the primary cause of excessive gear response. The effects of the design parameters on this class of modes are then explored, which can lead to less sensitive design that attempts to achieve a balance between mesh force and vibration transmissibility. Geared systems with dominant time-varying and nonlinear mesh characteristics and their effects on dynamic response are discussed as well. Finally, the presentation will briefly touch on some advanced topics in gear dynamics including the development of coupled multi-body dynamics-vibration model and active vibration control of gear pair systems.

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