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"(OSU's Gear Dynamics & Gear Noise short course) is of particular interest to engineers and technicians involved in the analysis, manufacture, design specification, or utilization of simple and complex gear systems."

What is the instructional team's background in gear manufacturing and design?

Currently, the instructional team at Ohio State comprises of myself and Professors Ahmet Kahraman, David Talbot, and Don Houser, with significant contributions from Dr. Isaac Hong, Jonny Harianto, and Dr. Rajendra Gunda. This team brings a wealth of diverse industry experience, specializing in research and development related to design and manufacturing issues affecting noise, vibration, performance, fatigue, and durability. Notably, Houser initiated the course in 1978, and I joined in 1979. The course has a rich history, featuring collaborations with Donald Welbourn from Cambridge University, U.K., and Robert Munro from the University of Huddersfield, U.K., spanning from 1978 to the mid-'90s, offering valuable European industry insights. Over the past 45 years, the course has attracted over 2,550 engineers and technicians from more than 385 companies, with strong international participation, though the majority of attendees are from the United States.

What makes OSU the ideal place for learning about gear design and manufacturing?

The Ohio State University boasts unparalleled expertise in gear design, analysis, and manufacturing, emphasizing the inherent interconnectedness of manufacturing and design challenges. Both undergraduate and graduate students gain a comprehensive understanding of the interplay between manufacturing, design, and performance issues. The use of specialized analysis software, developed through over 40 years of research at Ohio State, leverages computational technology to assess and refine both manufactured surfaces, including intricate micro-geometry details and design alternatives, all within the constraints of production and performance criteria.

You are offering a short course on Gear Dynamics & Gear Noise June 3-6. What is the purpose of the course?

The aim of this distinctive four-day short course is to enhance understanding regarding the mechanisms behind gear-noise generation, the methodologies for measuring and predicting gear noise, and the techniques employed to reduce both gear noise and vibration. This course addresses a longstanding observation highlighted by Earle Buckingham in his 1949 book on the Analytical Mechanics of Gears: "It is not a question of why gears are noisy but rather why they are ever quiet." Emphasizing practical application, this course minimizes mathematical complexities in discussions of key concepts. Through case studies, participants gain insights into applying the learned principles to real-world challenges related to gear noise and vibration.

What is the primary focus of the course?

This course centers on understanding the sources of gear-whine noise, the paths through which it travels within structures, and the components that emit or receive it. While the majority of lectures focuses on these aspects, considerable attention is also dedicated to addressing gear rattle and clunk issues within drivelines. The course extensively explores gear dynamics, investigating how factors like tooth geometry, including micro-modifications, and effect of the operational speeds on the forced vibration and resonant behavior of the entire geared system, including its casing. Specifically, the course offers insights into the creation of gears with lower noise levels by optimizing tooth profiles, incorporating micro-modifications, and taking into account factors such as sliding friction, lubrication, and errors in the manufacturing processes. Leveraging the substantial industry experience within the instructional team, the course provides valuable perspectives on best practices and challenges associated with addressing real-world gear dynamics, whine noise, and gear rattle problems.

Will there be any lab work included?

Throughout the course, laboratory and computer software demonstrations are used to illustrate gear noise measurement and analysis techniques. The facilities of the Gear and Power Transmission Research Laboratory (gearlab.org) and the Acoustics and Dynamics Laboratory (mae.osu.edu/adl) are used for demonstrations as well. A few lectures include live demos using simple geared drives and computational codes.

Who should attend?

Industries that find this course helpful include the automotive (including the e-vehicles), transportation, wind-energy, process machinery, aircraft, appliance, general manufacturing, and all gear manufacturers. Attendees have diverse backgrounds including manufacturing experience, gear design, and product development and analysis/simulation and noise/vibration expertise. The course material is covered in such a way that the fundamentals of gearing, gear dynamics, noise analysis, and measurements are covered first. This makes the course appropriate to the gear designer with minimal knowledge of noise and vibration analysis as well as to the noise specialist with little knowledge of gears.

What are the short- and long-term impacts of the course?

The short-term advantages encompass the education of engineers newly entering this field. Participants gain expertise in experimental troubleshooting, computational problem-solving techniques, and the decision-making process. Over the long term, the thought-provoking questions or areas of limited comprehension raised during the short course have paved the way for high-quality graduate thesis topics and the establishment of the thriving OSU GearLab (Gear and Power Transmission Research Laboratory).

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