

Seminar Series

**Design, Electrodynamics and Demonstration of  
Ultrasonic Spherical Motors**

by

**Professor Hornsen (H.S.) Tzou, PhD.**

**National Scholar (Thousand-man), Professor, ASME Fellow**

**School of Aeronautics and Astronautics**

**Struc Tronics and Design Lab**

**Zhejiang University**

**Date: October 23, 2009 (Friday)**

**Time: 5:30pm to 7:00pm (Tea Reception at 5:00pm)**

**Venue: CAD Room (B1667), 1/F, Lift 4, MEEM  
Laboratory**

**ABSTRACT**

An ultrasonic spherical motor consisting of piezoelectric curvilinear drivers is designed and its electrodynamic characteristics are evaluated in this report. Fundamental design concept is discussed and its key component, i.e., a piezoelectric curvilinear arc driver, is evaluated. System equations, vibration behavior and wave propagation are investigated. A conceptual model of piezoelectric circular arc driver with required electronics is built and tested to demonstrate the feasibility and performance of the spherical motor. Fabrication of the piezoelectric circular arc driver, control circuits,

and implementation are respectively discussed. Experimental data of the conceptual curvilinear arc motor is compared with the finite element results. Operating frequency of the conceptual motor compares well with the finite element result. The conceptual model also demonstrates that the curvilinear arc motor performs as expected and is capable to achieve spherical motion

## **BIOGRAPHY**

Professor Hornsen (H.S.) Tzou earned his M.S. and Ph.D. from the School of Mechanical Engineering at Purdue University. He is one of the pioneers in the emerging technology of "smart structures and structronic systems." His research and teaching interests encompass smart structures and structronic systems, hybrid multi-functional photo-magneto/electro/elastic structures, dynamics and distributed sensing/control of discrete and distributed systems. He has authored and co-authored several research monographs and over 400 technical publications in journals, proceedings, and books and was named "One of the Most Cited Authors," by the *Journal of Sound of Vibration* in November 2006. Dr. Tzou has won six paper awards (including *ASME and AIAA Best-Paper Awards*) and two *NASA Class-1 New Technology Disclosure Awards* (2001 and 2003). He serves on several ASME technical committees, Associate Technical Editor and on several Editorial Boards. He is an ASME Fellow (1996) and a founding member of the ASME Adaptive Structures and Material Systems Committee. He was the General Chair of the 2007 ASME International Design Technical Conferences and Computers & Information in Engineering Conference (IDETC/CIE), composed of 13 conferences on various themes. He currently serves as Deputy (11/2007-...) of the ASME *Board on Technical Knowledge Dissemination* (BTKD), *Technical Communications Operating Board* (TCOB) and Chair (11/2008-...) of *Interdisciplinary Councils*, ASME BTKD.

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Enquiry: 2788 8420

***All are welcome!***