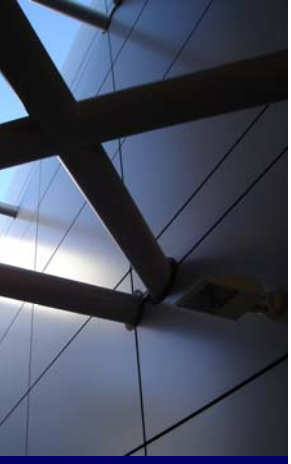

COLLOQUIUM
MECHANICAL ENGINEERING

The Department of Mechanical Engineering presents:

Dr. L. Roy Xu

Department of Mechanical Engineering
University of Texas at El Paso

Friday, January 11, 2013
11:10AM-12:00PM
Bourns Hall A265

Impact and Indentation Mechanics if Advanced Materials— From Nanometer Measurements to Microsecond Observations

Abstract:

Recently, extensive applications of advanced composite materials are found in aerospace, civil and marine structures, for example, more than 50% materials used in new Boeing 787 "Dreamliner" are composite materials. Also, composite materials are increasingly employed in naval battle ships, and earthquake engineering due to their high strengths, stiffness and light weights. However, traditional metals or concrete and composites must co-exist since composites may not completely replace metals in the future. Therefore, a major mechanics research effort is the interfacial failure between composites and metals, because the damage tolerance of composites and metals is excellent.

This talk will summarize some new mechanics and materials research results across extremely small time-scales and length-scales. The first topic is the nano-indentation research for composite materials. We recently develop an efficient approach to measure the out-of-plane Young's moduli of composite laminates. Moreover, nanoindentation results obtained from Hertz's indentation law are employed to estimate the low-speed impact behaviors of composite laminates. The second topic is the impact failure mode transitions at the interface of composites or hybrid materials. A series of dynamic failure experiments were conducted using high-speed optical diagnostic techniques. For the first time, the sequence and interaction of two major dynamic failure modes— delamination (which just occurred in new Boeing 787 airplane) and matrix cracking were revealed in real time. Furthermore, enlightened by experimental observations of the crack deflection/penetration at the interface, new failure criteria were proposed.

Bibliography:

L. Roy Xu is an Associate Professor of Mechanical Engineering. After he received the Ph.D. degree in Aeronautics and Materials Science from Caltech, he joined Vanderbilt University as a faculty of Civil Engineering and Materials Science, before his current position. His honor and award include an Office of Naval Research (ONR) Young Investigator Award, and a Fellow of the American Society of Mechanical Engineers (ASME). He is the Chair of the ASME Fracture and Failure Mechanics Technical Committee. As an author of 41 journal papers (h-index 13), his interdisciplinary research includes failure analysis and structural and materials designs for aerospace, civil and marine applications, nanotechnology including nanocomposite materials and nanoindentation, experimental mechanics and fracture/failure mechanics, funded by the National Science Foundation and ONR.