SWANSON school of engineering

civil & environmental engineering

The University of Pittsburgh Department of Civil and Environmental Engineering announces
The 2009 Landis-Epic Lecture

Friday March 20, 2009 at 4 pm in the Frick Fine Arts Auditorium

MODELING AND SIMULATION OF COMPLEX STRUCTURES: FROM PHYSICAL TO BIOLOGICAL SYSTEMS

J. N. Reddy
Distinguished Professor and *Oscar S. Wyatt Endowed Chair*
Department of Mechanical Engineering Texas A & M University

Computational mechanics is an integral and major component in many fields of engineering, design, and manufacturing. Major established industries such as the automobile, aerospace, atmospheric sciences, chemical, pharmaceutical, and petroleum, as well as emerging industries such as biotechnology and information technology rely on computational mechanics-based capabilities to model and simulate complex systems for the analysis, design, and manufacturing of high-technology products. In this lecture, mathematical models and computational methodologies for numerical simulations of complex shell structures and biological systems will be discussed.

The development of accurate shell theories has been one of the most important research activities. It is important to develop appropriate mathematical models together with efficient finite element formulations that can accurately represent the kinematics of deformation and stress fields in shell structures. In the present lecture, a shell finite element based on a consistent shell theory for geometrically nonlinear analysis of shells will be presented.

Biological materials are complex hierarchical systems subjected to external stimuli in the form of mechanical forces, chemical potentials, and electrical signals. A deeper understanding of the behavior of biological systems is critically important for situations like diagnosis and treatment of serious diseases. Understanding the behavior of biomaterials requires extensive experimental studies; however, mathematical models and computational methodologies can provide an alternative to understanding these complex processes. The lecture will discuss computational frameworks, including multiscale, multiphysics models capturing processes at a sub-cellular scale (e.g. transduction of chemical signals), the microscopic scale (e.g. interaction of cells with other cells and substrates), and also at the macroscopic scales (e.g. cell migration, blood flow). These computational tools offer immense help in understanding and solving some of the significant medical problems facing biomedical research.

Professor J.N. Reddy holds the special rank of Distinguished Professor and was selected in a national search as the inaugural holder of the Oscar S. Wyatt Endowed Chair since 1992. The extent of Dr. Reddy's original and sustained contributions to education, research, and profession societies is substantial. He has earned a sterling national and international reputation for his research and education in composite materials and structures and computational methods (especially, theory and applications of the finite element method). There are very few researchers and educators in the world who have achieved so much in so many diverse fields of engineering (fluid mechanics, heat transfer and solid and structural mechanics) and applied mathematics as Professor Reddy.

The **Landis-Epic Lectureship** was established by the Department of Civil and Environmental Engineering in 1991 in honor of Donald H. Landis, president of Epic Metals Corporation and a 1952 graduate of the University of Pittsburgh. An outstanding businessman and engineer, Mr. Landis is nationally recognized as leader in the design and construction of cold-formed steel structures. This distinguished lectureship is made possible through the generosity of Mr. Landis.