KTH SOLID MECHANICS KEYNOTE SEMINAR; Thursday, November 16th, 16.15; https://kth-se.zoom.us/j/65986500563

Erasmo Carrera
"A CUF-based Framework for Next Generation Theory of Structures and FE Applications"

The assumptions of classical beam, plate and shell theories often lead to solutions that could deviate significantly from the exact ones. On the other hand, the use of simplified nonlinear relations (such as von Kármán approximations) could lead to large errors to detect the correct solutions when the equilibrium path is far from the undeformed configurations. Current FE implementation, including those in commercial software, are characterized by a fixed/limited number of degrees of freedom per nodes. Normally these are 'six' for structural elements and 'three' for 3D solid ones. These constraints could lead to severe limitations to solve 'localized' stresses/fields, laminated composite and/or metallic structures, electromechanical problems and structures subjected to multifield loadings. In the recent years, the author and co-workers have successfully introduced and extended the Carrera Unified Formulation (CUF) which is a hierarchical framework to develop any theory of structures for beams, plates and shells including laminated structures and multifield loadings. These have been extended and applied to linear and nonlinear problems with excellent accuracy. The lecture describes some of the most interesting problems solved by CUF. Accurate stress/vibration response in laminates beams, plates, shells; buckling and post-buckling of thin-walled structures; plasticity, progressive failure in laminates, low-velocity impact. The lecture shows that such accuracy could be only achieved using solid-3D Finite Elements if commercial software is referred to, nevertheless, the computation costs of 3D analysis could become prohibitive.

Erasmo Carrera is Professor of Aeronautics and Astronautics at Politecnico di Torino. He has introduced the Unified Formulation, or CUF (Carrera Unified Formulation), as a tool to establish a new framework to develop theories of beams, plates and shells for metallic and composite multilayered structures. He has been author and co-author of about 800 papers and holds various 'best paper award' and the 'JN Reddy Medal'. He acts as President of AIDAA and has been visiting professor at the University of Stuttgart, Virginia Tech, Royal Melbourne Institute of Technology, Tambov University, Supmeca and Ensam, PMU. He is founder and Editor-in-Chief of Advances in Aircraft and Spacecraft Science, Editor-in-Chief of Mechanics of Advanced Materials Structures and Section Editor of Journal and Sound and Vibration. Professor Carrera has been Highly Cited Researchers (Top 100 Scientist) by Thompson Reuters and acquired research funding from numerous public and private organisations, such as the European Community, European Space Agency, Thales Alenia Space and Embraer. Carrera has been awarded by the President of Italian Republic, as 'Honoray Commendator'.