

SPRING 2006 SEMINAR SERIES

Date: Thursday, March 9, 2006

Time: 11:00 am - 12:00 pm

Room: SL 165

Reception at 10:45 am (cookies and refreshments served)
Everyone is invited

**Coupled Finite Element Modeling of Flexible Multibody Dynamics and
Liquid Sloshing**

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Abstract. Many practical applications include flexible multibody systems carrying liquid filled tanks. The multibody system can be a ground vehicle (truck, train, or car), ship, airplane (jet, helicopter, etc.), or a space system (launch vehicle, space station or satellite). The tank can be a payload tank or a liquid fuel tank. In this seminar a time-accurate finite element model (FE) for simulating the coupled dynamic response of flexible multibody systems and liquid sloshing in tanks is presented. The semi-discrete combined solid and fluid equations of motions are integrated using a time-accurate parallel explicit solver. The FE model consists of: hexahedral, beam, and truss solid elements; rigid bodies; joints; actuators; hexahedral incompressible fluid elements; and quadrilateral fluid-solid interface elements. The fluid mesh is modeled using a very light and compliant solid mesh which allows the fluid mesh to move/deform along with the tank using the ALE formulation. The fluid's free-surface is modeled using a volume-of-fluid algorithm. An object-oriented graphical modeling environment, which allows creating the finite element model and viewing the simulation results, will also be presented.

About the Speaker. Dr. Wasfy is president and founder of Advanced Science and Automation Corp. He received a B.S. (1989) and a M.S. (1990) in Mechanical Engineering from the American University in Cairo, and a Ph.D. (1994) in Mechanical Engineering from Columbia University. Prior to his current position, he worked as a research scientist at Columbia University and at the University of Virginia/NASA Langley Research Center. Dr. Wasfy authored and co-authored 55 peer-reviewed publications in the areas of flexible multibody dynamics, finite element modeling of solids and fluids, belt-drive dynamics, tires mechanics, visualization of numerical simulation results, engineering applications of virtual-reality, and artificial intelligence. Dr. Wasfy served as PI on a number of federal and state funded research projects related to the aforementioned areas. He led the development of several software codes that are used by automotive/aerospace companies, government agencies, and academic institutions. Those include: a time-accurate finite element code for modeling flexible multibody systems and fluid flow and an object-oriented virtual-reality engine. He is a member of ASME, AIAA, and SAE.