CENTER FOR FLUID MECHANICS
AND THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING
SEMINAR SERIES

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Space-Time Techniques for Fluid-Structure Interactions

We describe the space-time finite element techniques we developed for computation of fluid-structure interaction (FSI) problems. Among these techniques are the Deforming-Spatial-Domain/Stabilized Space-Time (DSD/SST) formulation and the Enhanced-Discretization Space-Time Technique (EDSTT). Also among these techniques are the block-iterative, quasi-direct and direct coupling methods for the solution of the fully-discretized, coupled fluid and structural mechanics equations. The EDSTT was developed for the purpose of being able to, in the context of a space-time formulation, enhance the time-discretization in regions of the fluid domain requiring smaller time steps. Such requirements are often encountered in time-accurate computations of fluid-structure interactions, where the time-step size required by the structural dynamics part is smaller, and carrying out the entire computation with that time-step size would be too inefficient for the fluid dynamics part. A good coupling method for the solution of the fully-discretized equations becomes essential in computation of FSI problems where the structure is light. We present numerical examples where the fluid is governed by the Navier-Stokes equations of incompressible flows and the structure is governed by the membrane and cable equations. We also present some FSI test computations to show how the EDSTT works. Overall, we demonstrate that the techniques we have developed have increased the scope and accuracy of the methods used in FSI computations.

TUESDAY – NOVEMBER 1, 2005
Barus & Holley, Room 190
3:00pm