ENHANCED-DISCRETIZATION SPACE–TIME TECHNIQUE (EDSTT)

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The Enhanced-Discretization Space–Time Technique (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. In the EDSTT-Single-Mesh (EDSTT-SM) approach, a single space–time mesh, unstructured both in space and time, would be used to enhance the time-discretization in regions requiring smaller time steps. In the EDSTT-Multi-Mesh (EDSTT-MM) approach, we complement the space–time concept of the Deforming-Spatial-Domain/Stabilized Space–Time (DSD/SST) formulation with the multi-mesh concept of the Enhanced-Discretization Interface-Capturing Technique (EDICT). In applications to fluid–structure interactions, the structural dynamics modeling is based on a single space–time mesh and the fluid dynamics modeling is based on two space–time meshes. The structural dynamics interface nodes in the space–time domain also belong to the second fluid mesh, which accommodates the time step requirement of the structural dynamics. We apply the EDSTT-SM and EDSTT-MM approaches to a number of test problems to demonstrate how these methods work and why they would be desirable to use in time-accurate computations.