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OVER-COMING THE FLUID-STRUCTURE ADDED-MASS INSTABILITY FOR INCOMPRESSIBLE FLOWS

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The added-mass instability has, for decades, plagued partitioned FSI simulations of incompressible flows coupled to *light* solids and structures. Many current approaches require tens or hundreds of expensive sub-iterations per time-step. In this talk two new stable partitioned algorithms for coupling incompressible flows with both compressible elastic bulk solids [2] and thin structural shells [3] are described. These added-mass partitioned (AMP) schemes require no sub-iterations, can be made fully second- or higher-order accurate, and remain stable even in the presence of strong added-mass effects. The approach extends the scheme of Banks et al. [1, 4] for compressible flow, and uses Robin (mixed) boundary conditions derived directly from the governing equations The new schemes are shown to be stable through the analysis of model problems. Exact traveling wave solutions are derived for three FSI model problems of increasing complexity, and these solutions are used to verify the stability and accuracy of the corresponding numerical results obtained from the AMP algorithm for the cases of light, medium and heavy solids.

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