Overcoming added-mass instabilities for fluid-structure interaction

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In this talk, I will discuss recent work concerning the development and analysis of stable, partitioned solvers for fluid-structure interaction (FSI) problems. In a partitioned approach, the solvers for each fluid or solid are isolated from each other and coupled only through common interfaces. The discrete formulation of the interface conditions has a strong influence on the overall stability of the approach, and partitioned solvers are historically found to suffer from added-mass instabilities. Here I will present a new class of provably stable partitioned FSI solvers that avoid added-mass instabilities. The approach is based on the imposition of locally exact solutions to the fully coupled differential operator along interfaces. Results will be presented for both compressible and incompressible flow regimes, and stability of the FSI coupling will be discussed using normal-mode stability theory.