Computational fluid mechanics and fluid–structure interaction

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Preface

A number of special issues of this journal on computational fluid mechanics and fluid–structure interaction (FSI) were published in the past five years. These special issues were very successful in terms of the kind of articles included and the attention those articles received following their publication. These research areas of computational mechanics, especially computational FSI, have seen major advances in method power and much expansion in computational challenges addressed. Advances in core computational technologies, including variational multiscale (VMS) methods, space–time (ST) techniques, and isogeometric analysis, and in special techniques targeting specific classes of problems, including biomechanics, parachute FSI, and wind-turbine modeling, played a key role in making that happen. All these motivated the dedication of one of the 25th anniversary special issues of the journal to computational fluid mechanics and FSI.

The special issue includes papers focusing on different aspects of this class of problems, including method development, method analysis, meshing and remeshing, mesh refinement studies, computational efficiency, simulation-based analysis and design, verification and blending with experimental data, and industrial applications.

The core and special methods presented include arbitrary Lagrangian–Eulerian (ALE) formulations, ST techniques,

VMS, ALE-VMS and ST-VMS methods, mixed interface-tracking/interface-capturing technique, mixed finite-element/boundary-element method, immersed smoothed finite element method, coupled PFEM-Eulerian approach, energy approach, methods for weakly enforced interface and essential-boundary conditions, spatial and temporal NURBS techniques, spatial- and temporal-data extraction techniques, parallel iterative methods, quasi-implicit methods with local and dual time stepping, discrete spectrum analysis techniques, and stabilized finite element RANS turbulence models with special stabilization for dominant reaction-like terms.

The applications targeted include aortic valves, patient-specific blood flow in cerebral arteries with aneurysm and stent, spacecraft and spacecraft parachutes, inflatable structures, complete wind-turbine systems, aerodynamics of flapping wings of an actual locust, bio-inspired flapping-wing aerodynamics of a micro aerial vehicle, ship hydrodynamics, elastic structures containing liquids with capillarity, seepage through a rockfill dam with free-surface flow and structural response, vibration of rod bundles in a fluid at rest, and noise reduction in axial fans.

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