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Unstructured Cartesian/Immersed Boundary Method for Flow Simulations in Complex 3D Geometries[1] DIANE DE ZELICOURT, CHANG WANG, HIROUMI KITAJIMA, KEREM PEKKAN, Georgia Institute of Technology, FOTIS SOTIROPOULOS, University of Minnesota, AJIT YOGANATHAN, Georgia Institute of Technology — Unstructured grids with finite-difference solvers allow one to tackle the complexity of the geometries encountered in numerous engineering or bioengineering applications. However, these are cumbersome to implement and considerably more expensive than similar methods applied on Cartesian grids. In Cartesian methods the arbitrary geometrical complexity can be handled using immersed-interface type algorithms in conjunction with sharp-interface, reconstruction techniques. A major issue is that often the majority of the grid nodes of the background Cartesian mesh within which the flow domain is immersed end up lying outside the computational domain, increasing the memory and computational overhead without increasing the simulation accuracy. The method presented here overcomes this situation by combining the simplicity of the Cartesian grids with the versatility of unstructured grids. We will both demonstrate the efficacy of our methodology and its accuracy by applying it to realistic cardiovascular geometries in the context of the total cavo-pulmonary connection and comparing our results to their experimental counterpart.

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