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Optical Flow-Based Modeling and Velocimetry SETH DILLARD, JAMES BUCHHOLZ, H.S. UDAYKUMAR, University of Iowa Department of Mechanical and Industrial Engineering — One of the challenges involved with modeling organisms and other complex systems using CFD simulations lies in describing their complex geometries and motions with fidelity. We have developed a framework to overcome this difficulty by employing imagery as a basis from which to directly create such models. By combining nonlinear optical flow with image segmentation techniques, we are able to generate a level set field that moves under the influence of optical flow vectors computed on an image sequence, and thereby supply an immersed boundary to our flow solver. All of these operations take place on a fixed Cartesian mesh, obviating the complexities associated with fitted grid methods. These methodologies can also be applied to experimental flow velocimetry, and offer significantly enhanced spatial resolution compared with correlation methods used in particle image velocimetry. Preliminary application of the nonlinear optical flow methodology to planar fluid flow measurements will be demonstrated.

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