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Patient-Specific Modeling of Intraventricular Hemodynamics[1] VIJAY VEDULA, ALISON MARSDEN, Stanford University — Heart disease is the one of the leading causes of death in the world. Apart from malfunctions in electrophysiology and myocardial mechanics, abnormal hemodynamics is a major factor attributed to heart disease across all ages. Computer simulations offer an efficient means to accurately reproduce in vivo flow conditions and also make predictions of post-operative outcomes and disease progression. We present an experimentally validated computational framework for performing patient-specific modeling of intraventricular hemodynamics. Our modeling framework employs the SimVascular open source software to build an anatomic model and employs robust image registration methods to extract ventricular motion from the image data. We then employ a stabilized finite element solver to simulate blood flow in the ventricles, solving the Navier-Stokes equations in arbitrary Lagrangian-Eulerian (ALE) coordinates by prescribing the wall motion extracted during registration. We model the fluid-structure interaction effects of the cardiac valves using an immersed boundary method and discuss the potential application of this methodology in single ventricle physiology and trans-catheter aortic valve replacement (TAVR).

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