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Patient-Specific Computational Fluid-Structure Interaction (FSI) Modeling of Full Cardiac Cycle[1] MOHAMMAD MEHRI, MATTHEW FIG, MAYSAM MOUSAVIRAAD, University of Wyoming — A patient-specific computational fluid-structure interaction (FSI) model of full-cycle cardiac dynamics is presented. One-way and two-way coupling simulations are carried out for 2D and 3D geometries. The patient-specific 3D left ventricle (LV) geometry is constructed from 2D echocardiography images based on biplane ellipsoid model. One-way coupling studies use the wall motions and the pressure-volume (PV) loop data to specify the solid and fluid boundary conditions. The two-way coupled simulations model the myocardium passive dynamics with anisotropic Mooney-Rivlin method. Active contractions are modeled by stiffening and softening the myocardial material properties calculated as part of the one-way studies. The compressibility of blood is included in the model to produce the entire curve of the PV loop. The wall motions and PV loop data are used to validate the two-way results. Next steps will include invariant-based orthotropic models for passive behavior of myocardium and electrophysiology models for active contractions. The valvular dynamics will also need to be included for improved vorticity dynamics modeling.

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Maysam Mousaviraad
University of Wyoming

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