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High resolution simulation of the left heart hemodynamics in patient-specific anatomies TRUNG LE, IMAN BORAZJANI, FOTIS SOTIROPOULOS, University of Minnesota — Understanding left-ventricle (LV) hemodynamics is critical prerequisite for developing new methods for diagnosing, treating and managing left heart dysfunction diseases. We develop a high resolution computational model of the left heart based on data from MRI scan images from a healthy volunteer and develop a physiologic, cell-activation based model for calculating the kinematics of the LV chamber wall motion. At the mitral position, uniform pulsatile flow is specified while a bi-leaflet mechanical heart valve is placed at the aortic position. The CURVIB fluid-structure interaction methodology of Borazjani et al. (J. Comp. Physics, 2008) is extended to simulate the flow and ensuing motion of the aortic valve leaflets. The computed results show that the LV motion resulting from the model gives rise to global left heart parameters (e.g. heart rate, ejection fraction etc.) that are well within the human physiologic range. In addition the computed flow patterns during diastole are found to be in good agreement with previous in vitro and in vivo experimental observations. The model also provides the first insights into the flow patterns of the aortic mechanical valve leaflets in an anatomic left heart system. This work was supported by NIH Grant RO1-HL-07262 and the Minnesota Supercomputing Institute.

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