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Direct Numerical Simulation of turbulent flow induced by prosthetic heart valves[1] ANTONIO CRISTALLO[2], ELIAS BALARAS, Dept. Mechanical Engineering, University of Maryland, College Park, MD 20742, ROBERTO VERZICCO, Dipartimento di Engegneria Meccanica e Gestionale, Politecnico di Bari, Bari, Italy — The complex turbulent flow patterns downstream of mechanical bileaflet valves are to a large extend responsible for the thromboembolic complications that remain a major concern after surgery. To illuminate the detailed dynamics of flow in the vicinity of such valves we performed Direct Numerical Simulations in a simplified configuration. The selected shape and size of the leaflets roughly mimics the SJM Standard bi-leaflet. Also, the housing was a straight pipe with rigid walls which expands and then contracts to mimic the geometry of the aortic root. The overall set-up resembles the one commonly used in in-vitro experiments. The computation of the fluid structure interaction problem is performed using a fully coupled, embedded boundary formulation at physiologic flowrates. The valves open at the beginning of the systole and close before the start of the diastole. The interaction of vortices originating from the leaflets and the housing dominate the flow in the downstream proximal area and are responsible for most of the production of turbulent stress.

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