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An in vitro experimental study of flow past aortic valve under varied pulsatile conditions. RUIHANG ZHANG, YAN ZHANG, North Dakota State Univ — Flow past aortic valve represents a complex fluid-structure interaction phenomenon that involves pulsatile, vortical, and turbulent conditions. The flow characteristics immediately downstream of the valve, such as the variation of pulsatile flow velocity, formation of vortices, distribution of shear stresses, are of particular interest to further elucidate the role of hemodynamics in various aortic diseases. However, the fluid dynamics of a realistic aortic valve is not fully understood. Particularly, it is unclear how the flow fields downstream of the aortic valve would change under varied pulsatile inlet boundary conditions. In this study, an in vitro experiment has been conducted to investigate the flow fields downstream of a silicone aortic valve model within a cardiovascular flow simulator. Phased-locked Particle Image Velocimetry measurements were performed to map the velocity fields and Reynolds normal and shear stresses at different phases in a cardiac cycle. Temporal variations of pressure across the valve model were measured using high frequency transducers. Results have been compared for different pulsatile inlet conditions, including varied frequencies (heart rates), magnitudes (stroke volumes), and cardiac contractile functions (shapes of waveforms).

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