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An experimental study of pulsatile flow over rectangular sidewall cavities RUIHANG ZHANG, BENJAMIN EICHHOLZ, YAN ZHANG, North Dakota State University — Open cavity flow is a classic benchmark fluid dynamic model that has been extensively studied over the past decades. The existence of the free shear layer causes variations of vortex structures and flow stagnations inside the cavity in different flow regimes. However, how the flow pulsatility affects the vortex dynamics of the cavity flow is still not fully understood. Such question is of critical importance to many biological flow phenomena, such as blood past the brain aneurysms and left atrial appendage blood flows. The goal of this study is to reveal the flow characteristics of two simple rectangular sidewall cavity models under physiologically-relevant pulsatile flow. Cavities with two depth-to-width ratios were studied. Flow waveforms were generated using a programmable pulsatile pump to mimic the heart functions. Phase-locked PIV were conducted to study the cyclic variation of vortex flow structures inside and across the cavity. The velocity and vorticity fields were analyzed and found to significantly vary at different peak Reynolds numbers, Womersley numbers, and pulsatility indices. This study represents a systematic experimental effort towards pulsatile flow over a standard cavity model, which could serve as a benchmark for future computational simulations.

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