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Resonances in pulsatile channel flow with an elastic wall[1] DUO XU, Center of Applied Space Technology and Microgravity, University of Bremen, MATTHIAS HEIL, University of Manchester, THOMAS SEEBCK, Friedrich-Alexander-Universitt Erlangen-Nrnberg, MARC AVILA, Center of Applied Space Technology and Microgravity, University of Bremen — Fluid flows through elastic conduits are ubiquitous in engineering and physiology. For the case of pulsatile and oscillatory flows, such as blood flow in the arteries and air flow in the respiratory airways, the flow time scale interacts with the natural time scales of the vessels. We investigate this interaction in a channel flow driven by a pulsatile pressure difference. The bottom channel wall is rigid, whereas an elastic membrane is clamped between two rigid sections of the upper wall. Our simulations show that after a transient determined by the viscosity of the fluid, the membrane pulsates with the driving frequency. Interestingly, the amplitude of the oscillation varies non-monotonously with the governing parameters and exhibits strong resonances. The membrane response is determined by multiple governing parameters, but we show that it can be quantitatively modeled with a harmonic oscillator equation (with non-conventional damping). All key features of the system are predicted by our model: oscillation amplitude, phase lag, resonance point and vanishing of the resonance when viscous damping dominates.

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