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Vortex propagation around a wall-mounted obstacle in pulsatile flow[1] IAN A CARR, MICHAEL W PLESNIAK, George Washington University — Wall-mounted obstacles are prevalent in nature and engineering applications. Physiological flows observed in human vocal fold pathologies, such as polyps, can be modeled by flow over a wall-mounted protuberance. Despite their prevalence, studies of wall-mounted obstacles have been restricted to steady (constant velocity) freestream flow. In biological and geophysical applications, pulsatile flow is much more common, yet effects of pulsatility on the wake of a wall-mounted obstacle remain to be extensively studied. This study aims to characterize the complex physics produced in this unsteady, separated flow. Experiments were performed in a low-speed wind tunnel with a set of rotating vanes, which produce the pulsatile inflow waveform. Instantaneous and phase-averaged particle image velocimetry (PIV) results acquired around a hemispherical obstacle are presented and compared. A mechanism based on self-induced vortex propagation, analogous to that in vortex rings, is proposed to explain the observed dynamics of coherent structures. Predictions of the propagation velocity based on analytical expressions for vortex rings in a viscous fluid are compared to the experimentally measured propagation velocity. Effects of the unsteady boundary layer on the observed physics are explored.

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