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Surface obstacles in pulsatile flow[1] IAN A. CARR, MICHAEL W. PLESNIAK, George Washington University — Flows past obstacles mounted on flat surfaces have been widely studied due to their ubiquity in nature and engineering. For nearly all of these studies, the freestream flow over the obstacle was steady, i.e. constant velocity unidirectional flow. Unsteady, pulsatile flows occur frequently in biology, geophysics, biomedical engineering, etc. Our study is aimed at extending the comprehensive knowledge base that exists for steady flows to considerably more complex pulsatile flows. Beyond the important practical applications, characterizing the vortex and wake dynamics of flows around surface obstacles embedded in pulsatile flows can provide insights into the underlying physics in all wake and junction flows. In this study, we experimentally investigated the wake of four canonical surface obstacles: hemisphere, cube, and circular cylinders with aspect ratio of 1:1 and 2:1. Phase-averaged PIV and hot-wire anemometry are used to characterize the dynamics of coherent structures in the wake and at the windward junction of the obstacles. Complex physics occur during the deceleration phase of the pulsatile inflow. We propose a framework for understanding these physics based on self-induced vortex propagation, similar to the phenomena exhibited by vortex rings.

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