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Controlling vortex breakdown through heat addition and extraction[1] XIAO ZHANG, University of Maryland, JOSEPH CHUNG, University of Maryland, College Park, CAROLYN KAPLAN, University of Maryland, ELAINE ORAN, Texas A&M University — This work examines how heat addition and extraction can be used to control the modes of vortex breakdown. Three-dimensional, unsteady simulations of gaseous vortex breakdown were carried out by solving the unsteady Navier-Stokes equations. Different modes of vortex breakdown were obtained by matching swirl and Reynolds numbers from the literature. Then, heat was either extracted or added within the vortex core to quantify the influence of non-adiabatic conditions. The results show that a critical value of heat extraction will force a laminar, columnar vortex to transition to a spiral and then to the double helix mode of breakdown. Heat addition with the double helix mode, however, will force the double helix to transition to a columnar vortex, entirely bypassing the spiral mode. We discuss these results and other findings related to the bubble mode of breakdown.

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