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System identification and model-based control of two-dimensional cavity oscillations SIMON ILLINGWORTH, University of Cambridge, AIMEE MORGANS, Imperial College London, CLARENCE ROWLEY, Princeton University — Direct numerical simulations are used to characterize the resonant instabilities in two-dimensional compressible flow over a rectangular cavity. Specifically, by first using a dynamic phasor model to stabilize the flow, the cavity's linear open-loop transfer function is determined. The transfer function's input and output consist of a body force at the cavity leading edge and a pressure measurement on the trailing edge wall respectively. The transfer function found allows comparison with and validation of a linear model of the cavity. The empirical transfer function is also used to design a model-based feedback controller, useful for reducing oscillations at a a single operating point, or as a starting point for an adaptive controller. Numerical simulations of the closed-loop system show that the model-based controller successfully stabilizes the cavity flow.

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