

Abstract Submitted
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Reduced-order Modeling and Estimation for Buoyancy-driven Flow Control SANJANA VIJAYSHANKAR, Department of Electrical and Computer Engineering, University of Minnesota, PIYUSH GROVER, Mechanical and Materials Engineering, University of Nebraska-Lincoln, SALEH NABI, Mitsubishi Electric Research Labs — We consider the problem of data-driven reduced-order modeling and state estimation of buoyancy-driven turbulent flows in the built environment. First, we investigate the efficacy of data-driven techniques such as Eigen-system Realization Algorithm (ERA) and Dynamic Mode Decomposition (DMD) for systems described by Boussinesq equations. The resulting reduced-order models are suitable for real-time control applications. We employ these reduced-order models to construct reduced-order observers for systems operating in forced and mixed convection regimes. Exhaustive numerical simulations (both DNS and RANS) in the context of energy efficient buildings and internal flows are provided to validate the accuracy and computational benefits of this approach.

Saleh Nabi
Mitsubishi Electric Research Labs

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