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Principal interval decomposition framework for POD-based model reduction of convective flows OMER SAN, Oklahoma State University, JEFF BORGGAARD, Virginia Tech — A principal interval decomposition (PID) framework is proposed to build more reliable reduced-order models for unsteady flow problems. The PID method optimizes the lengths of the time windows over which proper orthogonal decomposition (POD) is performed and can be highly effective in building reduced-order models for convective problems. The performance of these POD models with and without using the PID approach is investigated by applying these methods to the unsteady lock-exchange flow problem modeled by solving the Boussinesq equations in vorticity-streamfunction formulation. This benchmark problem exhibits a strong shear flow induced by a temperature jump and results in the KelvinHelmholtz instability. This is considered a challenging benchmark problem for the development of reduced order models. The predictive performance of our model is then analyzed over a wide range of computational modeling and physical parameters. It is shown that the PID approach provides a significant improvement in accuracy over the standard Galerkin POD reduced-order model. Our numerical assessment of the PID shows that it may represent a reliable model reduction tool for convection-dominated, unsteady-flow problems.

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