

Abstract Submitted
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Linear stability analysis of scramjet unstart¹ IK JANG, Stanford Univ, JOSEPH NICHOLS, University of Minnesota, PARVIZ MOIN, Stanford Univ — We investigate the bifurcation structure of unstart and restart events in a dual-mode scramjet using the Reynolds-averaged Navier-Stokes equations. The scramjet of interest (HyShot II, Laurence et al., AIAA2011-2310) operates at a free-stream Mach number of approximately 8, and the length of the combustor chamber is 300mm. A heat-release model is applied to mimic the combustion process. Pseudo-arclength continuation with Newton-Raphson iteration is used to calculate multiple solution branches. Stability analysis based on linearized dynamics about the solution curves reveals a metric that optimally forewarns unstart. By combining direct and adjoint eigenmodes, structural sensitivity analysis suggests strategies for unstart mitigation, including changing the isolator length.

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