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Nonlinear dynamics of hydrogen-air detonations with detailed kinetics and diffusion JOSEPH POWERS, CHRISTOPHER ROMICK, University of Notre Dame, TARIQ ASLAM, Los Alamos National Laboratory — We consider the calculation of unsteady detonation in a mixture of calorically imperfect ideal gases with detailed kinetics. The use of detailed kinetics introduces multiple reaction length scales, and their interaction gives rise to complex dynamics. These are predicted using a wavelet-based adaptive mesh refinement technique and includes multi-component species, momentum, and energy diffusion, as well as DuFour and Soret effects. In the one-dimensional limit, we predict a transition from stability to unstable limit cycles as a driving piston velocity is lowered. At low overdrive, energy is partitioned into a variety of high frequency oscillatory modes. For weak low frequency instabilities, the dynamics are largely explained by a competition between advection and reaction time scales, with diffusion serving to perturb the dynamics. For higher frequency instabilities, the influence of diffusion is larger. We present new extensions to two-dimensional dynamics.

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