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Hydrogen-air detonation cells computed using skeletal and reduced reaction mechanisms DAVID KESSLER, BRIAN TAYLOR[1], VADIM GAMEZO, ELAINE ORAN, Naval Research Laboratory — The multidimensional instability of gas-phase detonations results in a complex dynamic structure at the detonation front that leaves behind characteristic cellular patterns as it propagates. In fuel-air mixtures with high effective activation energies, such as hydrogen and air, these detonation cells can become irregular and modelling this behavior using reduced chemical reaction mechanisms can be challenging. Using complex reaction mechanisms, however, can be computationally overwhelming for problems of practical interest. We compare the reaction front structures and dynamic behavior of two-dimensional detonations in a stoichiometric hydrogen-air mixture computed using a 12-step skeletal mechanism and several reduced mechanisms, including a calibrated one-step model. We pay particular attention to how transverse instabilities that form in this high-activation-energy mixture are affected by the details of the chemistry model. We then discuss how to adjust the parameters in reduced reaction models to better describe irregular triple point behavior.

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