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Route to instability in cellular detonations MATEI I. RADULESCU, University of Ottawa, GARY J. SHARPE, University of Leeds, JAMES J. QUIRK, Los Alamos — Through highly resolved direct numerical simulations of detonation cellular structures performed on large domains, we show that with increasing sensitivity of the reaction rates, the cellular front transits from a regular pattern to a highly irregular one, characterized by transverse wave merging and formation of new triple points on the front. We formulate a new method to study the distribution of the spacings between triple points of the same family and correlate their distribution with the sensitivity of the reaction rates. It is found that past a critical value of activation energy, a period doubling bifurcation occurs, with the preferred cell size having twice its original value. Simultaneously, higher frequency oscillations appear through a period halving bifurcation, hence significantly broadening the range of characteristic cell sizes of the front. The non-linear mechanisms responsible for the generation of these higher modes is discussed.

Matei Radulescu
University of Ottawa

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