Transition to longitudinal instability of detonation waves is generically associated with Hopf bifurcation to time-periodic galloping solutions

Benjamin Texier*

Université Paris-Diderot (Paris 7), Institut de Mathématiques de Jussieu, Paris, France
texier@math.jussieu.fr

Kevin Zumbrun

Department of Mathematics, Indiana University, Bloomington, Indiana
kzumbrun@indiana.edu

We show that transition to longitudinal instability of strong detonation solutions of one-dimensional reactive compressible Navier–Stokes equations is associated with appearance of unstable point spectrum, necessarily (by a result of Lyng and Zumbrun) outside the real axis. In the generic case of a Hopf bifurcation of a single pair of complex conjugate eigenvalues, we prove existence of nearby time-periodic “galloping”, or “pulsating”, solutions, in agreement with physical and numerical observation. The analysis is by pointwise semigroup techniques introduced by the authors and collaborators in previous works.