Resonant Oscillations: Interaction between Nonlinearity, Geometry and Inhomogeneity

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Abstract:

The propagation of acoustic waves in closed containers provides a natural context in which to study the mechanisms of shock formation in cylindrical[1,2] and more general settings[3]. Key to this is the fundamental interplay between nonlinearity, geometry and inhomogeneity of the underlying density profile. In order to illustrate and examine this, the case of an isentropic gas in an axisymmetric geometry provides a simple yet robust setting possessing these key features. Beginning with the associated system of model equations and applying a forcing along the axis of symmetry at or near resonance, the resulting linear and (weakly) nonlinear theory is developed through a perturbative framework. Comparisons with numerical approximations will then be drawn, providing a basis for further understanding and extension of the analytic results.

This work is in collaboration with M.P. Mortell (UC Cork) and B.R. Seymour (UBC)
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References:

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