Taylor dispersion and Turing-like instabilities of flames

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Abstract

We investigate the effect of Taylor dispersion on the thermo-diffusive instability of flames. This is a physically interesting and analytically tractable problem within a relatively unexplored class of problems pertaining to the interaction between Taylor dispersion (or flow-enhanced diffusion) and Turing-like instabilities in reaction-diffusion systems. The analysis is carried out in the Hele-Shaw burner configuration and adopts a constant density approximation. Depth-averaged equations are first obtained which incorporate Taylor dispersion and show that diffusion is effectively anisotropic. A linear stability analysis of travelling wave solutions leads to a simple dispersion relation. Based on the dispersion relation, stability-bifurcation diagrams are drawn in the parameters space and their physical implications are discussed.

Keywords: Taylor dispersion, Turing Instability, flame instability, mixing

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