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Two-dimensional corrugated flames - a consequence of the Darrieus-Landau instability ADVITYA PATYAL, MOSHE MATALON, University of Illinois at Urbana Champaign — In this study we present for the first time the development of corrugated flame surfaces resulting from gas expansion in a three-dimensional flow as a consequence of the Darrieus-Landau instability. The computations are carried out within the context of the hydrodynamic theory where the flame is treated as a surface of density discontinuity separating burned gas from the fresh combustible mixture, and its movement is tracked via a level-set method with a propagation speed that depends on the local curvature and hydrodynamic strain. To this end, a surface parameterization method is used to accurately capture the velocity jump across the flame and the strain rate along the flame interface. The numerical scheme is shown to accurately recover the exact pole-solutions predicted by the nonlinear Michelson-Sivashinsky equation in the weak gas expansion limit, and corroborates the bifurcation results from linear stability analysis. It is shown that, in accord with experimental observations, the new conformations that evolve beyond the instability threshold have a sharp crest pointing towards the burned gas with ridges along the troughs, and that these structures propagate steadily, nearly 50% faster than planar flames.

Advitya Patyal
University of Illinois at Urbana Champaign

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