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Burning invariant manifolds for reaction fronts in three-dimensional fluid flows[1] KEVIN MITCHELL, University of California, Merced, TOM SOLOMON, Bucknell University — The geometry of reaction fronts that propagate in fully three-dimensional (3D) fluid flows is studied using the tools of dynamical systems theory. The evolution of an infinitesimal front element is modeled as a six-dimensional ODE—three dimensions for the position of the front element and three for the orientation of its unit normal. This generalizes an earlier approach to understanding front propagation in two-dimensional (2D) fluid flows. As in 2D, the 3D system exhibits prominent *burning invariant manifolds* (BIMs). In 3D, BIMs are two-dimensional dynamically defined surfaces that form one-way barriers to the propagation of reaction fronts within the fluid. Due to the third dimension, BIMs in 3D exhibit a richer topology than their cousins in 2D. In particular, whereas BIMs in both 2D and 3D can originate from fixed points of the dynamics, BIMs in 3D can also originate from limit cycles. Such BIMs form robust tube-like channels that guide and constrain the evolution of the front within the bulk of the fluid.

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