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Influences of the Darrieus-Landau instability on premixed turbulent flames ADVITYA PATYAL, MOSHE MATALON, Univ of Illinois - Urbana — The propagation of turbulent flames in three-dimensional turbulent flows is studied within the context of the hydrodynamic theory. The flame is treated as a surface of density discontinuity with the flow modified by gas expansion resulting from heat released during combustion. The flame is tracked using a level-set method with a propagation speed that depends on the local flame stretch, modulated by a Markstein length. Impact of the Darrieus-Landau instability on the topology of the flame surface is studied. It is shown that similar to passive interfaces, flames under the influence of the hydrodynamic instability resort to cylindrical structures with increasing turbulence intensity, even in 3D. The mechanism of modification of vortical structures in the burned gas is identified in terms of the alignments between the vorticity vector, flame surface normal and eigenvectors of the strain rate tensor. The results indicate that the strain rate tensor is intricately coupled with the normal to the flame surface and creates anisotropy in the orientation of vortical structures, which begins to weaken as the turbulent intensity increases. Furthermore, vorticity budgets are used to highlight the relative importance of baroclinic torque due to Darrieus-Landau instability.

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