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Detailed analysis of premixed turbulent flame properties[1]
JOSEPH A.M. DE SWART, ROB J.M. BASTIAANS, JEROEN A. VAN OIJEN, L. PHILIP H. DE GOEY, Eindhoven University of Technology — Clean and efficient combustion is a hot topic. Many industrial applications are based on turbulent premixed combustion and it is very interesting to study these flames. Here we study statistically flat flames, because these can be regarded as essential parts of any complex turbulent flame. The flow is solved using Direct Numerical Simulation. The chemical kinetics are tackled using a chemical reduction technique, Flamelet Generated Manifolds. Two cases with different turbulence intensities are investigated. Different turbulence intensities result in different flame stretch rates, causing different flame structures. The effects of flame stretch on a turbulent flame are twofold: 1) the local flame speed changes and 2) the flame surface area changes. We present a detailed analysis of turbulent flame properties, including turbulent flame speed, mass consumption rate, actual flame surface area and Karlovitz integral. The Karlovitz integral describes the dimensionless flame stretch rate, integrated through the flame. These properties are valuable when testing new combustion models.

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