THREE-DIMENSIONAL DIRECT NUMERICAL SIMULATION OF TURBULENT COMBUSTION OF HYDROGEN–AIR AND METHANE–AIR MIXTURES IN THE FIELD OF SYNTHETIC TURBULENCE

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Abstract: The technique of three-dimensional direct numerical simulation of turbulent flame propagation in gaseous reaction mixtures under conditions of stationary, homogeneous, and isotropic synthetic turbulence is proposed. The technique is based on a detailed kinetic mechanism of combustion of a multicomponent mixture. The technique is applied to the calculation of the turbulent combustion of mainly fuel-lean hydrogen–air and methane–air mixtures. The calculated propagation speeds of a turbulent flame are in satisfactory agreement with the measured values. The calculated concentrations of the active reaction centers — OH, H, and O — are shown to be less in a turbulent flame than in the laminar flame which also agrees with experiment.

Keywords: direct numerical simulation; synthetic turbulence; turbulent combustion; detailed kinetic mechanism; hydrogen; methane

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