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AN EXPLORATORY INVESTIGATION OF RADIATION STATISTICS IN HOMOGONEOUS ISOTROPIC TURBULENCE

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Abstract

A fundamental study of radiation statistics in homogeneous isotropic turbulence is presented. A pseudo-spectral code is used to simulate isotropic turbulence by means of DNS of the full Navier-Stokes equations. The instantaneous scalar data is used to calculate the radiation intensity along a line of sight using the statistical narrow band model. The mean, variance, skewness and flatness of radiation intensity were obtained for conditions observed downstream of the flame tip of a piloted turbulent jet flame, where the statistics of the flow field are close to the ones found in isotropic turbulence. The joint probability density function between the temperature and the radiation intensity is presented, as well as the spectra for the radiation intensity. The present one way coupling philosophy used to connect isotropic turbulence data with radiation computations shows the correct trends and allows one to study the detailed effects of the turbulent characteristics upon the structure of the radiation intensity field.