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Theoretical Analysis of the Two-Scale Direct-Interaction Approximation for the Turbulent Passive-Scalar Field Including Molecular Viscosity and Diffusion Effects MASAYOSHI OKAMOTO, Department of the Mechanical Engineering, Shizuoka University — A fluctuating field of a passive scalar in turbulent flow is theoretically investigated by means of a two-scale direct-interaction approximation theory including the effects of a molecular viscosity and diffusion. Solving the fluctuating field in a perturbational manner, we get the energy and scalar intensity spectra and the eddy-viscosity representation for the Reynolds stress and scalar flux in the case that the Prandtl number is around 1. The derived spectrum of the passive scalar intensity is the Obukhov-Corrsin spectrum in the inertial subrange and is proportional to the -3 power law in the dissipation subrange. Applying the Pade approximation to the obtained spectrum expressions, the present spectra are consistent with the Pao's empirical ones. The new eddy-viscosity representations for the Reynolds stress and scalar flux include the molecular viscosity and diffusion effects through the turburent Reynolds number and Prandtl one.

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