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Radiation Transport Through a Particle Laden Turbulent Flow

HILARIO TORRES, GIANLUCA IACCARINO, Stanford University — Direct numerical simulations of a turbulent duct flow laden with small particles was performed at several Reynolds and Stokes numbers. After the flow reached a statistically stationary state the instantaneous particle positions were saved at several time steps. Separate radiative heat transfer calculations were performed to study the amount of absorbed radiation and the local heat flux. The radiative source was considered outside of the duct, and one wall contained a window from which thermal radiation streamed through. The fluid was treated as transparent and the instantaneous particle positions obtained from the DNS where used to build Eulerian absorption and scattering fields. A Monte Carlo ray tracing code has been developed and used to solve for the radiative intensity, incident radiation, and heat flux inside of the domain. The qualitative behavior of the radiation fields as the particle positions change due to the turbulence are discussed. The effects of changes in the resolution of the Eulerian mesh used to convert the Lagrangian particles into absorption and scattering fields are also presented. The sensitivity of the amount of total absorbed radiation in the domain is also discussed in both of the previously mentioned cases.

Hilario Torres
Stanford University

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