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Direct Numerical Simulation of Stationary Homogeneous Variable-Density Turbulence JAIYOUNG RYU, DANIEL LIVESCU, Los Alamos National Laboratory — The turbulence characteristics in statistically stationary turbulent flows composed of two incompressible miscible fluids with different densities are studied using Direct Numerical Simulations (DNS). When the two fluids have very different densities, the differential inertial effects lead to active scalar behavior. To distinguish this from the Boussinesq case, when the two fluids have commensurate densities, we call the former variable-density flows. In order to achieve a statistically stationary state, the velocity field is forced in the real space, using a linear forcing mechanism, while the active scalar field is de-mixed at a rate counteracting the normal diffusion processes using a real-space forcing based on a chemical reaction analogy. The active scalar influence on the turbulence characteristics are discussed as well as the ratios of turbulence to scalar scales for different Atwood, Schmidt, and Reynolds numbers and forcing properties. Finally, the decay of variable-density turbulence from various stationary states is also studied.

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