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Direct numerical simulation of turbulent two-phase flows: application to liquid sheet atomization

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ABSTRACT The atomization of fuel jets in car or plane engines involves complex process with multiphase motions and turbulent flow regimes in a highly coupled way. The Direct Numerical Simulation (DNS) of interfacial flows is investigated in order to characterize the coupling between turbulent flow structures and interface deformations occurring during atomization of a liquid sheet. An incompressible Ghost Fluid formulation of the Navier-Stokes equations is coupled to a level set interface tracking method for representing all the flow and interfacial scales at small scale. A Homogeneous Isotropic Turbulence (HIT) is considered which interacts with an initially flat liquid sheet surrounded by air. The DNS provides detailed simulations used to carry out a parametric study of turbulence-interface interactions according to density and viscosity ratios at the interface as well as surface tension magnitude.