Modelling atomization with phase change

DNS[1], LES [2] and RANS [3] modelling of atomization have been developed for the last decade in our laboratory with a particular attention devoted on the behavior of the interface. In particular model equations for the liquid-gas surface density have been proposed based on the pioneering work of Borghi and Vallet [4]. The purpose of this approach is to determine the surface density that we believe is the first order parameter to determine the mass transfer rate, a key future of fuel injection system. In addition to well-developed procedures usually used to evaluate the vaporization rate for dispersed spray based on the resolution of Boltzmann-Williams kinetic equation, our focus has been to determine the phase change rate for any kind of interface geometry not only spherical droplet. To do so the interface capturing DNS code Archer has been extended to handle heat and mass transfer at the interface based on the method proposed by Tanguy et al. [5], [6]. From this work the turbulent mixing of a scalar quantity issued from an interface such has the vapor concentration has been studied showing the importance of interface boundary layer zone on the global statistic of the scalar field [7]. Further works concern the extension of interface capturing method generally based on incompressible scheme to fully compressible code to handle other phenomena occurring during the injection process such as cavitation.

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