# Nozzle Geometry Effects on Primary Atomization

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**Abstract**

The increasing demand for predictive simulations of primary atomization (the complex process of spray formation right after the injection of liquid fuel) suggests pushing the inlet boundary condition upstream of the injection hole, so that effects due to the nozzle geometry can be properly included. In this work, we address the coupling between internal (with respect to the injection hole) and external flow, in relation to the spray characteristics of primary atomization. A simulation capability is presented where internal and external flow can be seamlessly calculated across the injection hole. The injection is assumed to be sub-critical, so that the external liquid-gas interface can be handled by the combined level-set volume-of-fluid (CLSVOF) method. The solid wall boundary is represented by a second level-set function $\psi$ on the same Cartesian, block-structured grid. A grid cell belongs to the physical flow domain if $\psi > 0$. Cells that are near the wall boundary, but outside of the flow domain, form a narrow band of ghost cells where velocity boundary conditions are assigned. Assuming no cavitation, results from the calculation of a scaled-up, transparent, six-hole Diesel nozzle are compared to experimental observations. Flow field features appearing just before the liquid is injected are highlighted, and their impact on spray characteristics is briefly discussed.