FLUENT 6.3 User's Guide

September 2006

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randomly selected in the plane orthogonal to the direction vector of the parent parcel, and the momentum of the parent parcel is adjusted so that momentum is conserved. The velocity magnitude of the new parcel is the same as the parent parcel.

You must also specify the model constants which determine how the gas phase interacts with the liquid droplets. For example, the breakup time constant B1 is the constant multiplying the time scale which determines how quickly the parcel will loose mass. Therefore, a larger number means that it takes longer for the particle to loose a given amount. A larger number for B1 in the context of interaction with the gas phase would mean that the interaction with the subgrid is less intense. B0 is the constant for the drop size and is generally taken to be 0.61.

22.8 Atomizer Model Theory

All of the atomization models use physical atomizer parameters, such as orifice diameter and mass flow rate, to calculate initial droplet size, velocity, and position.

For realistic atomizer simulations, the droplets must be randomly distributed, both spatially through a dispersion angle and in their time of release. For other types of injections in FLUENT (nonatomizer), all of the droplets are released along fixed trajectories at the beginning of the time step. The atomizer models use stochastic trajectory selection and staggering to attain a random distribution. Further information on staggering can be found in section Section 22.2.2: Stochastic Staggering of Particles.

Stochastic trajectory selection is the random dispersion of initial droplet directions. All of the atomizer models provide an initial dispersion angle, and the stochastic trajectory selection picks an initial direction within this angle. This approach improves the accuracy of the results for spray-dominated flows. The droplets will be more evenly spread among the computational cells near the atomizer, which improves the coupling to the gas phase by spreading drag more smoothly over the cells near the injection. Source terms in the energy and species conservation equations are also more evenly distributed among neighboring cells, improving solution convergence.

Five atomizer models are available in FLUENT to predict the spray characteristics from knowledge of global parameters such as nozzle type and liquid flow rate:

- plain-orifice atomizer
- pressure-swirl atomizer
- flat-fan atomizer
- air-blast/air-assisted atomizer
- effervescent/flashing atomizer

You can choose them as injection types and define the associated parameters in the Set Injection Properties panel, as described in Section 22.12.1: Injection Types. Details about the atomizer models are provided below.

22.8.1 The Plain-Orifice Atomizer Model

The plain-orifice is the most common type of atomizer and the most simply made. However there is nothing simple about the physics of the internal nozzle flow and the external atomization. In the plain-orifice atomizer model in FLUENT, the liquid is accelerated through a nozzle, forms a liquid jet and then breaks up to form droplets. This apparently simple process is dauntingly complex. The plain orifice may operate in three different regimes: single-phase, cavitating and flipped [348]. The transition between regimes is abrupt, producing dramatically different sprays. The internal regime determines the velocity at the orifice exit, as well as the initial droplet size and the angle of droplet dispersion. Diagrams of each case are shown in Figures 22.8.1, 22.8.2, and 22.8.3.

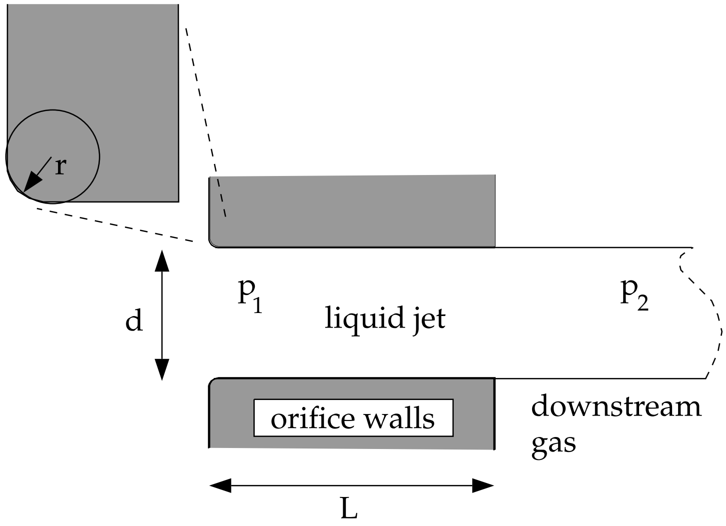

Figure 22.8.1: Single-Phase Nozzle Flow (Liquid Completely Fills the Orifice)

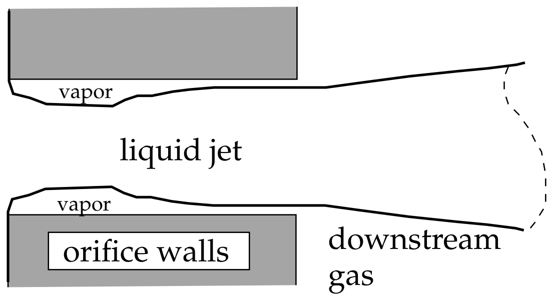

Figure 22.8.2: Cavitating Nozzle Flow (Vapor Pockets Form Just after the Inlet Corners)

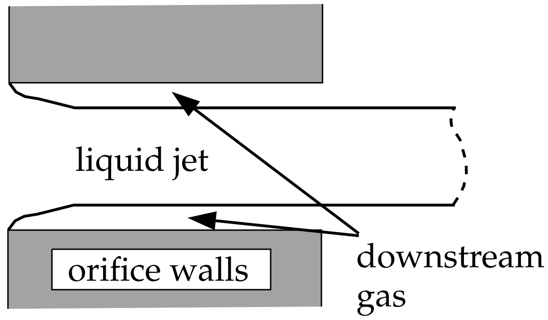

Figure 22.8.3: Flipped Nozzle Flow (Downstream Gas Surrounds the Liquid Jet Inside the Nozzle)

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