Comparison of various droplet break-up models in gas-liquid flows

H. Khaleghi and D. D. Ganji

Tarbiat Modarres University, Iran

The rate of droplet breakup affects the rate of spray penetration and evaporation, and plays a basic role in engine efficiency. In this research, with the aim of considering the rate of penetration and evaporation of droplets in the chamber and ultimately the efficiency of the engine liquid jet is injected into the compressed gas chamber in an axi-symmetrical way which causes a turbulent and unsteady flow. On the other hand, because of high compression of the air surrounded in the chamber, liquid jet is broken up and will deform into minute particles. These particles will also be broken up because of different aerodynamic conditions and secondary droplet breakup occurs by which new droplets are produced. Since there are various models to analyze break up of droplets and that each model is reliable in its particular condition, introducing a specific model to be compatible to different environmental conditions seems to be indispensable. In this research three models are implemented to study droplet breakup, and finally the best one is introduced. Getting to know the details of the flow requires solution of mass, momentum and energy conservation equations, turbulence and fuel vapor mass fraction and the equation of trajectory, momentum, mass and energy conservation in liquid phase. By using finite volume numerical method and PISO algorithm, these equations are solved. Various results of different models show that breakup in high pressure has affected the penetration and evaporation of spray and the size of droplets is the result of balance between breakup and rejoining of droplets. It is also shown that the details of atomization in the nozzle do not extensively influence the ultimate size of droplets.