

5<sup>th</sup> International Conference and Exhibition on

# MECHANICAL & AEROSPACE ENGINEERING

October 02-04, 2017 Las Vegas, USA



## *Prashant Khare*

*University of Cincinnati, USA*

### Atomization of liquid jets and droplets: Theory and Models

Liquid jets and droplets play an important role in numerous applications of practical interest including, liquid-fueled combustion devices such as diesel, gas-turbine and rocket engines, cooling of turbine blades and microchips, and industrial processes such as spray painting and inkjet printing. Even after decades of research, because of the lack of appropriate diagnostic and simulation tools, the understanding of the atomization process remains limited. No attempts were made in the past to conduct fundamental studies that led to the development of universal theories and models to predict statistics, such as, droplet/particles sizes and distributions, resulting from the fragmentation process. Additionally, the effect of multiphysics processes, such as vaporization, acoustic, electro-static and electromagnetic excitation on liquid sprays and droplets has not been widely explored. Therefore, this talk focuses on three aspects of the atomization process, (1) investigation of fundamental physics of the deformation and fragmentation of liquid droplets and jets; (2) development of generalized models to predict the behaviors of the products of liquid atomization over a wide range of operating conditions; and (3) the effect of multiphysics processes on the dynamics of multiphase flows. The theoretical and mathematical formulation to investigate these two-phase problems is based on a complete set of Navier-Stokes equations with surface tension. A critical issue is the treatment of multi-scale liquid-liquid and gas-liquid interfaces. A state-of-the-art, high resolution, volume-of-fluid (VOF) interface capturing method is adopted to resolve the interfacial evolution. Surface tension is accommodated as a Dirac delta distribution function on the interface. The theoretical formulation outlined above is solved numerically using a finite volume method augmented by an adaptive mesh refinement (AMR) technique, based on an octree spatial discretization, to improve the solution accuracy and efficiency. Based on the high-fidelity direct numerical simulations, general theories that quantitatively describe the atomization process over a wide range of operating conditions are established. These theories are used to develop universal models that can predict the droplet behaviors, including size-distributions and drag coefficients with deformation and fragmentation. Next, the effect of vaporization and electro-static fields on multiphase flows is explored and the essential physics is extracted. The ultimate goal of the effort is to enhance the fundamental understanding of multiphase flows, and to develop theories, models and algorithms for their active and passive control.

### Biography

Prashant Khare is currently working as an Assistant Professor in the Department of Aerospace Engineering & Engineering Mechanics at University of Cincinnati, USA. His research interest includes:- Multiphase Flows, Combustion, Liquid Propellants, Model Development and Data Analytics.

Prashant.Khare@uc.edu

### Notes: