National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Numerical and Analytical Study of the Impact of Droplets on Substrates of Various Topologies
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Venue	: ME-001 (SEMINAR HALL)
Date and Time	: 25 Oct 2024 (4.30 PM)
Abstract	:

Droplet impact, a common occurrence in everyday life such as rain hitting surfaces or ink spreading, has captured considerable interest across various scientific and technological domains like medicine, aerospace, and materials science. When a liquid droplet meets a solid surface, its behavior is shaped by a complex interplay of physical forces, including interfacial tension, gravity, and viscous effects, influencing its motion and spreading. This research primarily focuses on numerically and analytically studying the impact of droplets on substrates with various topologies. The present computational study utilizes finite volume-based axisymmetric simulations, employing the volume of fluid (VOF) method to anticipate intricate hydrodynamic phenomena. To conduct these simulations, the conservation equations for mass, momentum, and volume fraction are solved using the ANSYS Fluent 18.1 solver. Initially, the droplet surface undergoes continuous deformation upon impacting the thin cylindrical target, progressing through several critical stages: free fall, impact, cap formation, encapsulation, uncovering, and detachment. The computational study considers a range of cylinder-to-droplet diameter ratios *DcDo* from 0.13 to 0.4 to observe various deformation patterns of the droplet. The influence of parameters such as contact angle *&theta* , *DcDo,* Weber number *We* , Ohnesorge number *Oh* , and Bond number *Bo* , on the maximum deformation factor is analyzed based on numerical results.

Keywords: Droplet impact, VOF method, Maximum deformation factor, Weber number, Contact angle, Ohnesorge number, dynamic contact angle, liquid mass drainage.