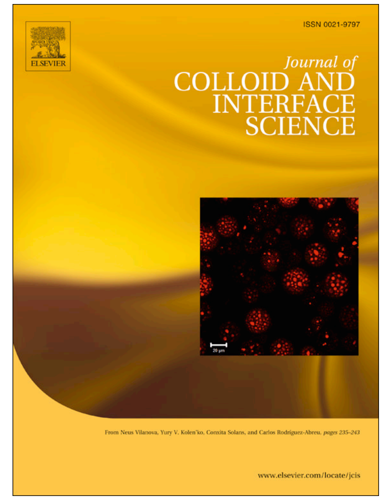
Accepted Manuscript



Numerical Investigation of Oblique Impact of Multiple Drops on Thin Liquid Film

Yisen Guo, Yongsheng Lian

PII: S0021-9797(18)30628-3
DOI: https://doi.org/10.1016/j.jcis.2018.05.107
Reference: YJCIS 23685

To appear in: *Journal of Colloid and Interface Science*

Received Date: 15 December 2017
Revised Date: 25 May 2018
Accepted Date: 29 May 2018

Please cite this article as: Y. Guo, Y. Lian, Numerical Investigation of Oblique Impact of Multiple Drops on Thin Liquid Film, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.05.107

Numerical Investigation of Oblique Impact of Multiple Drops on Thin Liquid Film

Yisen Guo, Yongsheng Lian*
Department of Mechanical Engineering, University of Louisville, Louisville, KY 40292, USA

Abstract

Hypothesis: When multiple drops impact on a thin liquid film, the interaction dynamic between two impinging drops is prominent. High-speed (> 50 m/s) oblique impacts of drops on a liquid film result in asymmetrical splashing patterns and further complicate the phenomenon. To understand the interaction between injected crowns from splashing, numerical simulations are very useful to study the flow behaviors.

Simulations: Three-dimensional simulations are performed to investigate the impact of two adjacent drops on a thin liquid layer using a multiphase flow solver. The solver solves Navier-Stokes equations on Cartesian grids and uses the moment-of-fluid method for interface reconstruction. The numerical code is first validated with three experimental studies and good agreements are obtained. Simulations of oblique impacts of two adjacent drops are then conducted for low-speed and high-speed impacts.

Findings: The numerical results show that strong interaction occurs when the crowns formed by two adjacent drops interfere with each other. For low-speed impact, drops deposit on to the liquid film with short and thick crater rims formed and the interaction region is a superposition of the crater edges. For high-speed impact, crowns break up to form splashing and the interaction behavior becomes complicated.

* Corresponding author.

E-mail address: yongsheng.lian@louisville.edu (Y. Lian)