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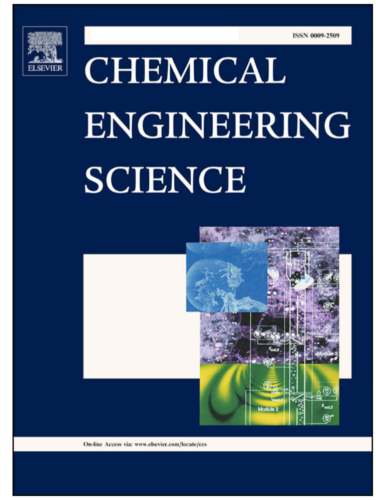

Dynamic capillary phenomena using Incompressible SPH

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Dynamic capillary phenomena using Incompressible SPH

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Abstract

Grid based fluid simulation methods are not able to solve complex non-linear dynamics like the rupture of a dynamic liquid bridge between freely colliding solids–an exemplary scenario of capillary forces competing with inertial forces in engineering applications–using a monolithic formulation for the solid and liquid phases present. We introduce a new Incompressible Smoothed Particle Hydrodynamics method for simulating three dimensional fluid-solid interaction flows with capillary (wetting and surface tension) effects at free surfaces. This meshless approach presents significant advantages over grid based approaches in terms of being monolithic and in handling interaction with free solids. The method is validated for accuracy and stability in dynamic scenarios involving surface tension and wetting. We then present three dimensional simulations of crown forming instability following the splash of a liquid drop, and the rupture of a liquid bridge between two colliding solid spheres, to show the method's advantages in the study of dynamic micromechanical phenomena involving capillary flows.

Key words: Incompressible Smoothed Particle Hydrodynamics, capillarity, Free surface, dynamic liquid bridge, splash crown

1. Introduction

Appreciation of non-linear micro mechanical phenomena is crucial to advance the efficiency of many production processes that are aided by the pres-

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