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A new approach for the numerical simulation of free surface incompressible flows using a meshfree method

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Abstract

This paper proposes a novel approach to solve free surface incompressible flows using Finite Pointset Method (FPM). Our approach is based in the Chorin-Uzawa's projection method and it corresponds to an extension of the work of Tiwari and Kuhnert [1] to solve general elliptic equations in a meshfree framework. The main features behind this approach, as well as details of the computational implementation are presented. Finally, the numerical results of the simulation of some test problems using this approach with first and second-order accuracy in time projection schemes are reported and compared with published experimental and theoretical results which show that this approach is promising for simulating free surface incompressible flows.

Keywords: Projection method, Free surface flow, Meshfree method, Finite Pointset Method, Generalized Finite Difference Method, Incompressible flow

1. Introduction

Numerical simulation is commonly used to study and analyze complex and rapidly changing free surface flows because it provides a large amount of detailed information that is difficult to obtain through other methods. Usually, such simulations are based on traditional mesh-based methods such as Finite Element Method (FEM) [2], Finite Difference Method (FDM) [3] and Finite Volume Method (FVM) [4], and they use Volume-of-Fluid Method (VOF) to track free surfaces [5], [6], [7].

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