



基于罚函数SPH新方法的水模拟充型过程的数值分析

*强洪夫, 韩亚伟, 王坤鹏, 高巍然

(第二炮兵工程学院201教研室, 陕西, 西安 710025)

NUMERICAL SIMULATION OF WATER FILLING PROCESS BASED ON NEW METHOD OF PENALTY FUNCTION SPH

*QIANG Hong-fu, HAN Ya-wei, WANG Kun-peng, GAO Wei-ran

(No.201 Xi'an Hi-Tech Institute, Xi'an, Shaanxi 710025, China)

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摘要 同传统的网格法相比,光滑粒子流体动力学(SPH)方法非常适合于求解大变形和自由表面流动问题。阐述了SPH理论及其应用,并用罚函数处理流体与壁面的相互作用,以解决传统SPH本质边界条件不易施加的问题。对水模拟的充型过程实验进行数值分析,并和文献实验结果以及传统SPH进行对比,最终表明仿真结果与实验非常吻合,比传统SPH方法捕捉到了更多的流动细节和特征;同时由于使用了XSPH算法,使得粒子更加整齐有序。

关键词: 光滑粒子流体动力学法 罚函数法 本质边界条件 流体体积法 XSPH

Abstract: Comparing with a traditional mesh method, it has been found that the Smoothed Particle Hydrodynamics (SPH) method is an attractive alternative method to solve large deformations and free surface problems. In this paper, the applications of SPH theory was presented, and the penalty function was used to deal with the interaction of fluid and fixed wall to overcome the disadvantage of traditional SPH in imposing essential boundary conditions. The two dimension flowing state of a water filling process was simulated and showed a good agreement with experimental results. Compared with the results of traditional SPH, it had captured more flowing characteristics, and the fluid particles were more orderly due to XSPH algorithm.

Key words: smoothed particle hydrodynamics method penalty function method essential boundary condition volume of fluid XSPH

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地址: 北京清华大学新水利馆114室 邮政编码: 100084

电话: (010)62788648 传真: (010)62788648 电子信箱: gclxbjb@tsinghua.edu.cn

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