Effects of Multiple baffles on liquid sloshing by MPS method

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Abstract:

Liquid sloshing is a significant issue in the transportation of liquefied natural gas. The liquid inside a partially filled tank will be induced to violent oscillations and large impact pressure on the tank under external excitations which are large amplitude or resonance frequency of sloshing. In this paper, an in-house meshless particle solver MLParticle-SJTU, which is developed based on improved moving particle semi-implicit (MPS) method, is employed to numerically simulate effects of multiple baffles on liquid sloshing under surge excitation. At first, a rectangular tank without baffles is modeled to simulate liquid sloshing under surge excitation. The numerical impact pressure on tank walls are agreeable with experimental data. And the MLParticle-SJTU can also capture the complex flow phenomena comparing experimental photographs. Secondly, two horizontal baffles and two vertical baffles are installed in the tank, respectively. Comparing with results of the tank with no baffles, the horizontal baffles and vertical baffles are effective on reducing violent liquid sloshing. Finally, liquid sloshing in the tank with multiple baffles (two horizontal baffles and two vertical baffles) is modeled. The impact pressure and the deformation of free surface can be investigated clearly, indicating that multiple baffles can further reduce the impulse pressure. And the comparison between the numerical result and experimental data shows that MLParticle-SJTU is an effective tool to study liquid sloshing.