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Author: Dr. Jiawen Li
School of Astronautics, Beihang University, China, lijiawen@buaa.edu.cn

Mr. Tang Fei
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China, tangfeiepca@163.com

THE DISSIPATIVE PARTICLE DYNAMICS SIMULATION OF THE MOTION OF DROPS UNDER MICROGRAVITY

Abstract

The effects of sloshing propellant on the control system and movement stability of a spacecraft are very important and cannot typically be ignored. The nonlinear sloshing during a simulated thrusting burn is difficult to analyze using traditional methods. Thus, it demands appropriate simulation tools to analyze the motion of drops in microgravity environment. Dissipative particle dynamics (DPD) is a mesoscopic simulation method introduced by Hoogerbrugge and Koelman, which allows for larger time steps than molecular dynamics, can be applicable to analyze the motion of drops. In this paper, based on DPD method, revise random forces coefficient by using analytical approach of Bond number. Combined with equation of surface tension, use the DPD method to simulate the motion of drops under microgravity and to evaluate few effective parameters. The results show that the conservative force and the random force haven't nearly effect on the motion of drops under microgravity. However, the motion of drops is governed by Bond number. When Bond number is lower, the nonlinear behavior for the drops is more clearly. Because of random coefficient, the time evolution of instable motion of drops is influenced by the random force. The analysis is verified by comparing with earlier experimental results.