Paper ID: 19820
student

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Poster Session (P)

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INVESTIGATION ON FREE SLOSHING OF LIQUID IN TWO-DIMENSIONAL RECTANGULAR TANKS IN MICROGRAVITY

Abstract

With the continuous development of aerospace technology, liquid sloshing in microgravity is gaining more and more attention and further studies of liquid behavior in spacecraft become more important. Under microgravity conditions, the gravitational force becomes weak and the surface tension force at the free surface comes into play, influencing the statics and dynamics of the liquid. Effects of capillary forces on liquid sloshing with small amplitude in rectangular tanks are studied, considering two-dimensional situations to simplify derivation of equation and reduce computational cost. Research presented in this paper focuses on linear irrotational motion of the liquid around equilibrium, based on potential flow theory and assumption of rigid tanks. Methods of acquiring free surface in static equilibrium and deriving equations of free sloshing under microgravity conditions are given, and finite element method is used to solve the eigenvalue problem derived. Natural frequencies and modes of vibration of examples with different gravitational fields are presented, and comparative analysis is conducted between results in microgravity and in normal gravity to investigate the influences of capillary forces on the liquid.