Numerical simulation for finding the free surface of liquid in an open container with horizontal acceleration

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Abstract

Liquid sloshing is a crucial problem for the dynamic of moving containers. This problem which is also known as Faraday waves was subjected to the many problems of sloshing with different movements and different shapes of containers. Sloshing problems have been modeled mainly with fluid dynamics and equivalent mechanical parameter models and also with experimental analysis. The purpose of this research is to simulate the free surface of the liquid with mode shapes. The first step of this work is to find a simple linear design model based on Navier-Stokes equations. To this purpose, Irrotational movement of flow, and inviscid were assumed for the liquid. Displacement equation was determined with the separation variable to find the space variable of mode shape. Then, a laboratory experiment of liquid sloshing with the horizontal movement carried out to find the movement of the free surface of the liquid. This experiment was held by using high-speed cameras. Hence, the shapes of the free surface of the liquid, which were carried out with cameras, were simulated by using mode shapes.