EXPERIMENTAL STUDY OF SLOSHING OF LIQUID IN A TANK

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ABSTRACT

This thesis is presenting the development of experiment for the study of sloshing of liquid in a tank. Sloshing occurs when a partially filled tank of liquid goes through transient or steady external forces. Under such conditions, the free surface of the liquid may move and the liquid may impact on the walls of the tank, exchanging forces. These forces may cause numerous harmful and undesirable consequences in the operation of the vehicle, such as vehicle turn over. In this thesis the experimental results are catered towards validating the Computational Fluid Dynamic (CFD) simulation that has been done by PHOENICS.

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CHAPTER I

PRELIMINARY WORKS

1.0   Introduction

Liquid sloshing is associated with various dynamical system and engineering problem, such as the liquid oscillations in large storage tanks caused by earthquakes, the motions of liquid fuel in aircraft, the motion of liquid in containers and the water flow on the decks of ships. The dynamic behavior of these systems is greatly affected by the dynamics of the free liquid surface and it is very important with regard to the safety of transportation systems, human's life and environment.

Fluid motion in partially filled tanks may cause large structural loads if the period of tank motion is close to the natural period of fluid inside the tank. This phenomenon is called sloshing. Sloshing means any motion of a free liquid surface inside a container. Depending on the type of disturbance and container shape, the free liquid surface can experience different types of motion including simple planar, non-planar, rotational, irregular beating, symmetric, asymmetric, quasiperiodic and chaotic. The amplitude of the slosh in general depends on the nature, amplitude and frequency of the tank motion, liquid-fill depth, liquid properties and tank geometry. Motions of liquid inside a container have an infinite number of natural frequencies but it is lowest few modes that are most likely to be excited by the motion of vehicle. However, non-linear effects result