Results of the First Sloshing Model Test Benchmark

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ABSTRACT

A benchmark on Sloshing Model Test (SMT) installations has been conducted between 2011 and 2012, involving nine participants. This benchmark was based on simple tank geometry, excitation conditions and measurement set-up together with basic fluids, so that the majority of the sloshing research community could take part. Results have been gathered from eight of the participants, for a varying number of the specified conditions, depending on the respective testing capacities. Results are shown and discussed for seven of the fourteen initial excitation conditions. A way forward is proposed.

KEY WORDS: sloshing; LNG; benchmark; experimental; model test; hexapod, rectangular tank.

INTRODUCTION

During the 3rd sloshing symposium of ISOPE Conference (June 2011), a need was expressed to define reference test conditions to enable the comparison of experimental results from different testing facilities in the same way as has been done for years for model tests in towing tanks (especially in the framework of the International Towing Tank Conference, ITTC). GTT volunteered to organize such comparative tests: the first experimental benchmark on Sloshing Model Tests.

A specification was sent to the potential participants in September 2011 (see Gervaise, 2011). Fourteen test conditions at high filling levels have been proposed using a parallelepiped-shaped tank with one dimension much smaller than the two others (so-called 2D rectangular tank), in order to study two-dimensional liquid motions. Dynamic pressure measurements were asked for, with set-ups up to 72 sensors. The test fluids were simply water and air.

The test rig used by each participant is described in Table 1. Each participant used their own sloshing motion rig(s) to perform the benchmark conditions, which require at least one horizontal and one vertical translation with one rotation. The data acquisition system used for the experimental benchmark is described in Table 1.

EXPERIMENTAL SET-UPS

The specification introduced testing conditions enabling the majority of the sloshing community to participate. The general objective was to compare the measurements obtained by each participant under the same conditions.

The benchmark tests were to be performed using a 2D rectangular tank, whose inner dimensions were 946 mm x 118 mm x 670 mm. These dimensions were supposed to be sufficiently small to be used by numerous participants and large enough to be representative of the most common scales used in Sloshing Model Tests.

The test fluids were water and air, the filling levels were chosen to obtain impacts on the ceiling of the tank. The liquid motions at high filling levels are commonly viewed as easier to master than those at lower filling levels.

Dynamic pressure recording on the ceiling was requested, at specified positions. However, a choice on the number of sensors to be used was allowed. Other measurements that could bring support for discussions were suggested.

Each participant has completed an ID form describing their facility and the way the benchmark tests were performed. The description included the sloshing motion rig, the tank, the sensors, their configuration and the data acquisition system used for the experimental benchmark. This section summarizes the results of this survey.

Test Rig

Each participant used their own sloshing motion rig(s) to perform the benchmark conditions, which require at least one horizontal and one vertical translation with one rotation. Characteristics of the different motion rigs used are presented in Table 1.