ABSTRACT

Sloshing experiments are reported with a rectangular tank filled with three fluids of different densities. The tank undergoes harmonic and multichromatic forced motions, in sway then roll. The positions of the interfaces at the tank end are video-tracked and RAOs are extracted through image processing and Fourier/spectral analysis. An analytical model, based on linearized potential flow theory, is described and its predictions are compared with experimental RAOs, with good agreement. Comparisons are also presented with results from a fully nonlinear CFD code with VOF tracking of the interfaces. This investigation is relevant for the design of wash-tanks installed aboard FPSOs.

KEY WORDS: Sloshing; multi-fluid; wash-tank.

INTRODUCTION

The proposed paper is to record a method of sloshing characterization in wash-tanks installed aboard FPSOs. Wash-tanks, alike separators, have the main purpose of separating oil and water. In-between oil and water an emulsion layer with an intermediate constant density is assumed to exist in this study (see fig. 1). At the design stage it is necessary to check that no undesirable resonant motion of the interfaces take place, under wave induced motion of the floating support.

A numerical model based on linearized potential flow theory is first presented, that gives the RAOs of the elevations of the three interfaces under forced sway or roll motion of the rectangular tank. Dissipative terms are introduced via small pressure jumps at the interfaces, tailored to dissipate the same amount of energy as viscous processes at the walls and/or at the interfaces.

Figure 1: Schematic view of a wash-tank.