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Investigation of Gap Effect in Slamming Experiment

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ABSTRACT

This study presents the result of investigation of gap effect in slamming experiment. The transverse gap, longitudinal gap, and vertical air gap effects were investigated. The pressure at the center was measured to estimate the variation of pressures. It was found that the smaller the transverse and longitudinal gaps, the larger the pressure is. As the vertical air gap increases, the magnitude of peak pressure increases. It can be concluded that the measured pressure can be very dependent on those gaps.

KEY WORDS: free fall slamming, transverse gap, longitudinal gap, vertical air gap, air pocket, impact pressure, pressure time history,

INTRODUCTION

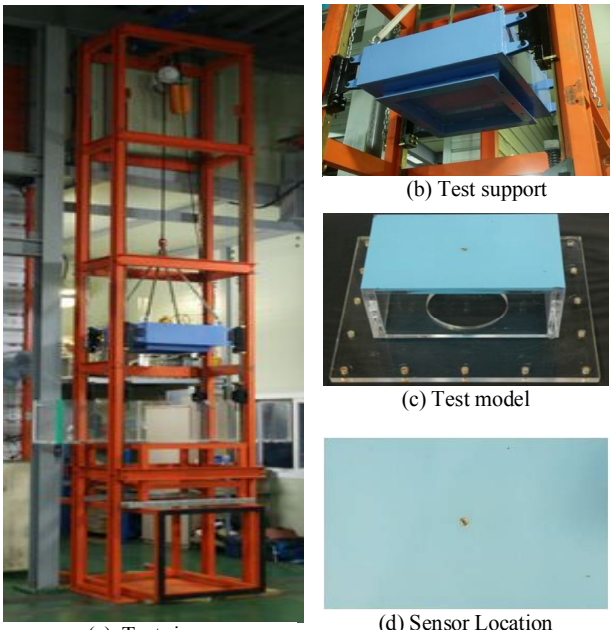
When it comes to the slamming experiment there are many factors which affect the time history of the impact pressures. They are impact velocity, deadrise angle of the model, length of the model. Not many researchers in this community speak about the effect of the ratio of the water plane area and area of the model bottom. It is anybody's guess that when this ratio gets small, the pressure time history might be affected by the disturbance caused by the nearby wall of the tank. To consider the effect of this ratio, two definitions are introduced in this study. They are transverse and longitudinal gaps. Two different transverse gaps were tested to see its effect. Another gap introduced is the vertical air gap. Therefore horizontal and vertical gap effects were investigated at this investigation.

Chuang(1966) carried out slamming experiment at the model basin whose dimension is 7620mm x 4572mm x 2590.8mm(Length x Width x Depth). The size of his model was 508mm x 673.1 x 12.7mm (L x B x D). Therefore the ratio of water plane area and area of the model is very large. It means that the interaction between the tank wall and the model must be negligible. Chung et al. (2006) carried out an experiment to test the LNG insulation system at the tank size of 5000mm x 5000mm x 3000mm (L x W x D) while the size of the model was 1655mm x 1655mm x 500mm (L x B x T). Still the effect of the interaction was negligible. Verhagen (1967) performed slamming test at a tank size of 1000mm x 405mm x 400mm (L x W x D) and the size of the model was 400mm x 400mm x 20mm (L x B x T). This experiment was done with the same breadth of the tank and model. No comment was made about the effect of the side wall in this paper. Yamamoto (1983) investigated the effect of the breadth differences in the model. His experiment was done at the tank size of 1855mm x 505mm x 685mm (L x W x D) while the size of the model was 490mm x 250mmm (350mm, 500mm) x 20mm (L x B x T). He carried out the experiment to see the effect of the variation of the breadths.

The present study aims to see the effect of gaps in the slamming experiment. Two transverse gaps were tested while 6 different vertical air gaps were introduced. The effect of vertical air gap was very sensitive when the transverse gap is small. However, the vertical gap effect becomes less important when the transverse gap is large. Therefore present study reveals that the gap effect must be a one of the important factors which influence the pressure time history.

EXPERIMENTAL FACILITY AND MODEL

The experiment was carried out in wave flume at Pusan National University in Korea. The dimension of the whole structure of the drop test facility is 5445mm x 1060mm x 630mm (L x B x H) which is shown in Fig. 1. There are four rails to simulate free fall.



(a) Test rig (b) Test support (c) Test model (d) Sensor Location

Fig. 1 Slamming test facility