

Experimental and Numerical Studies of the TLP's Airgap

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1 Introduction

The height of the deck of a TLP is largely conditioned by the free surface elevation around the columns. The occurrence of high elevations influences both the cost of the platform and the safety of equipments.

In order to improve the knowledge in that domain, a french CLAROM project got started in 1996. The partners are: Bouygues Offshore, Bureau Veritas, Doris Eng., ESIM, Ifremer, Principia RD (leader) and Sirehna. It is a two years project and some results of the first phase are presented here. They concern the diffraction around four columns placed at the corners of a square. The second year is devoted to configurations of practical interest for the study of TLP in extreme and operating conditions. For example the surge motion is introduced both by letting free the surge motion and by towing the model in regular or irregular waves.

Experiments are achieved in the model basin in Ecole Centrale de Nantes. A parametrical study is performed for a variation of the column diameter, two orientations of the structure: 0° and 45° with respect to the direction of the wave propagation and for a large range of wave steepnesses. Both regular and irregular waves are studied.

The experimental data bank is used to improve and validate the existing theoretical models. Different numerical approaches are used: semi-analytical formulations and numerical diffraction programs based on potential flow theory.

For the regular waves, first and second orders quantities are compared: these results are encouraging in the limit of small steepness hypotheses *i.e.* in the limit of the linear theory.

Resonant phenomena are observed when the half wavelength is equal to the gap between two tandem cylinders; they are not reproduced numerically but the near-trapped modes (as described in Evans and Porter 1997) should be analyzed; this is done in scolan and Malenica (1998). For the irregular waves, the time signals are compared: it is shown that second order diffraction will improve the existing models.

2 The experimental campaign

The set-up is described in the figure (1). The model is simply composed of bottom mounted and fixed vertical cylinders of circular cross section. One of the longitudinal walls of the basin is used as a symmetry plane; the TLP model is thus composed of 2 cylinders at incidence 0° and $1 + 2 \times 1/2$ cylinders at incidence 45° . With this choice the problems of blockage are practically avoided and it significantly reduces the perturbation due to the reflected waves on the opposite longitudinal wall. An additional wave absorber is placed on this wall. These precautions are necessary to obtain a sufficiently long period for data acquisitions without spurious harmonics. This is of crucial importance particularly when second order quantities are to be measured. Seven wave gauges are placed in the vicinity of the four columns as described in figure (2). The following tables summarize the main dimensions of the model and the position of the wave gauges: