

Title of Diploma Thesis

Numerical Modelling of a Modular Floating Structure by Harnessing Field Monitoring Data

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ABSTRACT

The development of floating breakwaters and their role as protective measures of lakes and coastal activities in order to reduce incident wave energy are, nowadays, of particular interest. The utilization of a structural health monitoring system can significantly contribute to the efficient operation of a floating breakwater during its life cycle, since such a system supports the implementation of cost-efficient, timely maintained actions and/or the timely utilization of protection measures against failure. Moreover, the potential of predicting the remaining lifetime of a floating breakwater through the combined use of appropriate data and validated numerical models bring new perspectives in the field of floating marine structures.

The subject of this thesis deals with the time domain numerical modelling of the hydrodynamic behavior of the floating breakwater in the port of Neos Marmaras, in Chalkidiki, Greece and the validation of the corresponding numerical model by utilizing field measurements. These measurements are obtained by the sensor system, placed in a pair of flexibly connected floating modules of the breakwater, by the research team of Dr. D. Angelides, Professor Emeritus of Civil Engineering Department of Aristotle University of Thessaloniki. Considering, the complexity of the problem examined and the existence of multiple interacting factors, the development of a time domain numerical model describing the hydrodynamic behavior of a floating system is the key to a comprehensive assessments of its response. The numerical model was developed taking into account the interaction between the floating bodies and its individual structural components (mooring lines, connectors between the floating bodies) within marine environment (waves).

The physical quantities, which are discussed in detail and are obtained from this numerical model, correspond to the mooring lines' tension and to the vertical acceleration of the floating modules at positions, where the corresponding measuring equipment of the sensors' system is installed. By selecting a representative time period of operation of the sensors' system, the corresponding measurements are compared with the results of the developed numerical model aiming at its validation through the utilization of the available field measurements. The numerical model developed describes satisfactorily the response of the floating breakwater and so, it can be used, for example, in order to investigate to study the effect of the connectors' failures on the hydrodynamic response of the floating structure.

Keywords: Floating breakwater, Time domain numerical modeling, Field measurements, Mooring lines' tension, Vertical acceleration.