Title of Diploma Thesis

Development of a Numerical Code for the Hydrodynamic Analysis of Floating Structures in Time Domain

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Academic Year

2016-2017

ABSTRACT

The objective of the present thesis is the development of a numerical code for the hydrodynamic analysis of floating structures in time domain. The reason that this topic was chosen is the intense dealing of all the engineers around the world with calculation modules, which give the ability of transitioning from frequency to time domain. Moreover, time domain analysis has important advantages compared to the frequency domain analysis, since in time domain: (a) details regarding the structure's motions are given at each time-step of the simulation, (b) non-linear effects can be introduced and (c) memory effects are also taken into consideration.

The present numerical code, named as FLOS-time module, was developed using the Python programming language. The main assumptions made were: (a) application of linear wave theory and (b) consideration of a freely floating rigid body. Consequently, the response of the structure is described using six degrees of freedom (three translations and three rotations corresponding to rigid body motions). The action of both regular and irregular waves can be taken into account.

In order to validate the present numerical code, comparisons with numerical and experimental results of previous researchers were carried out. Very good comparison of results was obtained, illustrating the reliability of the FLOS-time module.

Finally, FLOS-time module is applied for the case of a free floating heaving Wave Energy Converter (WEC) in order to calculate the absorbed power considering the action of both regular and irregular waves.

Keywords: Floating structures, Numerical modeling, Time domain, Wave energy converters.