On the wave induced effects on the movement of wind speed floating measurement platforms

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1. Introduction

Although considerable knowledge concerning the stability of floating structures can be found in the literature, this knowledge seems not to have been applied yet in the design of floating structures to be used for off-shore wind measurements.

2. Approach

In the present work the stability of floating structures to be used for off-shore wind measurements is being examined on theoretical grounds. Modelling of the anchoring methodologies using sets of springs have been applied to take into account the effect of anchoring on the movement of the structure and specific guidelines for the design of those structures have been developed and presented.

3. Main Body

Based on the equation of motion:

$$M * \frac{d^2n}{{d_t}^2} + B * \frac{dn}{d_t} + C * n = F(t)$$

a theoretical approach to predict the heave, pitch and surge motion of a floating semisubmersible structure has been developed.

To solve the equations of motion the proper values of mass, damp and restore coefficients should be defined.

With the use of strip theory the excitation forces induced by the waves have been calculated, by taking into account the wave amplitude, the wave frequency and the wave length. Then, by substitution to each equation of motion, the calculation of the motions n_i of the floating structure induced by the waves has been achieved.

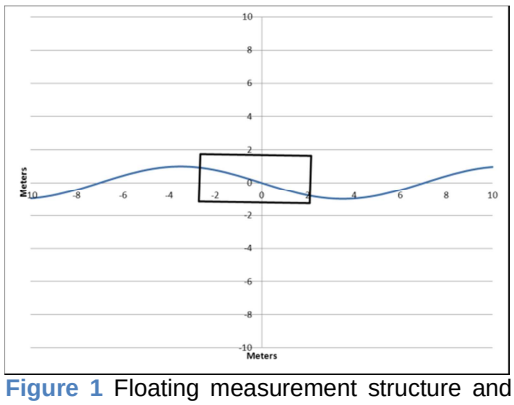

Figure 1 Floating measurement structure and incident wave.

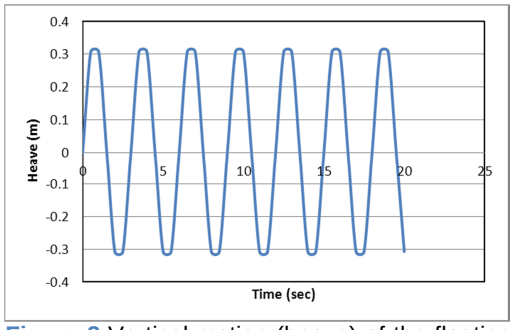

Figure 2 Vertical motion (heave) of the floating structure in meters.

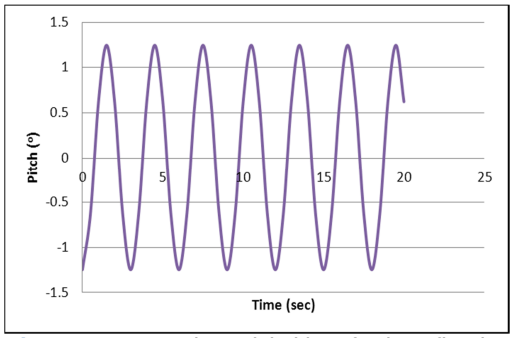

Figure 3 Rotation (pitch) of the floating structure in degrees.

4. Conclusion

The work done shows that it is possible to predict with accuracy accepted in engineering practice the movement of the wind measurement structure by applying the fundamental equations of motion. Results can be used to design floating structures exhibiting a prescribed degree of motion suitable for wind measurements. Additionally the effect of the anchoring can be modeled and taken into account.

5. Learning Objectives

We can use the fundamental equations of motion to help designing floating wind measurement structures which exhibit a prescribed degree of movement. In this way more efficient floating measurement structures can be built.

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Acknowledgments: This work has been partially supported by the Hellenic State innovation program under contract 1142-BET-2013