THESIS INFORMATION

INTRODUCTION

Official thesis title:	Development and application of a combined boundary element method and moving element method for the dynamic analysis of very large floating structures
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CONTENT

Summary of findings of the thesis

The major focus of this thesis is on the introduction of highly effective numerical techniques to the modeling responses of Very Large Floating Structures (VLFSs) subjected to moving loads based on the frameworks of the Boundary Element Method (BEM) and Moving Element Method (MEM). To the best knowledge of the author, this is the first work where the following two main issues are tackled. Firstly, for the region where the water depth is relatively deep, it is different from the previous works in which MEM was solely adopted for the structures, BEM employed for VLFSs is re-established in a moving coordinate system. Moreover, the matrices represented to the interaction of structure with fluid are also introduced in this coordinate system. That results in the introduction of a new hybrid method called the BEM-MEM. Secondly, in the case of shallow water, the MEM is firstly developed for not only the structural domain but also the fluid region and the interaction between them. Therefore, these new methods own the benefit of the MEM including a compliance minimization of treating the boundaries and tracking the contact points, and the independence of the computational domain on the distance of moving loads. The results gained by using the proposed methods are compared with those determined by the Fourier Transform Method (FTM), the hybrid coupled Boundary-Finite Element Method (BEM-FEM), and the experimental results to show the effectiveness, robustness, and reliability of the present

methods. Additionally, the BEM-MEM and MEM are utilized for the analysis of responses of VLFS with emphasis on the effect of the water depth, stiffness of tires, orthotropic property and material angle. On the other hand, the multi-layer plate with an elastic core is firstly proposed for mitigating the effect of water action on transportation.

The applicability in practice

In the research and practical design of very-large floating structures involving hydroelastic behavior induced by mobile loads, a convenient method, which saves time and computer resources and ensures the accuracy, for the analysis of the behavior of the structure is one of the essential requirements. The boundary element method and the moving element method developed in this thesis provide a solution saving computational time and being accurate compared to traditional methods. Therefore, this method might be useful in research and practical design.

Further research directions

In the thesis, the moving systems are assumed to “perfectly” contact with the plate. It is real if the non-linear factors of the contact between the wheel and plate are considered. The issue should be seriously study when dealing with rough surfaces.

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