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The Influence of Sloping Seabed on the Hydrodynamic Forces for a Ship Oscillating in Shallow Water

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ABSTRACT The influence of sloping seabed on the hydrodynamic forces is predicted. The hydrodynamic forces are computed numerically for a large tanker of the 200,000 TDW class, oscillating about a state of rest in four degrees of freedom (sway, heave, roll and yaw) in shallow water. A Galerkin finite element method is used to obtain a numerical approximation of the velocity potential, describing the flow around the moving ship. Automatic mesh generation is employed to divide the fluid domain around the ship into quadratic triangular elements. The factors affecting the hydrodynamic forces (frequency of ship motion and initial water depth) are also investigated. From the results, it is shown that the hydrodynamic forces are influenced by the sloping seabed especially in a very shallow water and in the low frequency range.

1. INTRODUCTION

With the increasing offshore activity and the large ships which have come into operation during the last decade the effect of restricted waters on the behaviour of ships becomes still more important. The influence of limited water depth on the behaviour of ships becomes perceptible when the water depth is less than about four times the draft of the ship, and when the ratio of water depth to draft is less than 2, the effect of the bottom becomes significant [1]. There is a need therefore to understand the effect of sloping seabed on the hydrodynamic forces and moments for ships oscillating in shallow water. This influence is important to study because the ships cannot be economically designed and constructed without the accurate estimate of expected hydrodynamic forces on the ships.

For the design of approach channels it is importance to study the vertical motions of a ship, sailing in shallow water, with regard to the danger of grounding. But it is also necessary, for the determination of the width of the channel to investigate the manoeuvring of ships in shallow water. Therefore, one should have