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Computation of lateral hydrodynamic forces during ship interactions in shallow water

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This thesis considers hydrodynamic ship interactions in shallow water. It is assumed that the ships are slender, the fluid is inviscid and incompressible, and that free surface effects can be neglected.

Four separate interaction problems are considered. The first is the interaction of a ship with some depth contour. Only steady interactions are considered, so the ship is moving at a uniform velocity parallel to any depth contours. Two particular contours, namely, a vertical wall and a beach of uniform slope, are considered and results presented.

The model is generalized to include the interaction of two or more slender ships in shallow water, moving in such a manner that the problem is steady. The cases of a flat bottom of uniform depth and a flat bottom with a vertical wall are considered. The results obtained for a wall are of particular interest when applying experimental results to actual ship interactions.

An unsteady model for two dimensional airfoil interactions is formulated next. This provides insight into the significance of unsteady effects in ship manoeuvres, when the bottom clearance is negligible. This work is then extended to provide a model for the unsteady interactions between two or more ships in unbounded shallow water, with underkeel clearance effects included.

Each of the above problems leads to an integral equation, or a system

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of integral equations, which has to be solved. A suitable algorithm is described in each case and used to compute results. Comparison with experiments shows that the algorithm is useful for computation of the sway force and yaw moment in practical problems. Where possible, qualitative discussions of these results are presented.

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