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Surface water waves in the vicinity of a solid body

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SUMMARY

Understanding wave propagation mechanisms on the sea has long been a subject of interest (cf.[1][2][3]). In this paper, we focus on modelling the wake of a solid body moving through the water. To this end, we study the flow of an inviscid, barotropic and compressible fluid around the solid body. The flow is considered as unidirectional and uniform far from the body, and perturbed locally by initial input excitation. The dynamic behaviour of the fluid is analysed by means of a two-dimensional coupled model consisting of an inner fluid model and a surface fluid model. The potential of velocity Φ and the normal displacement of the free surface η are used as main unknowns (cf.[4]). For convenience, the problem is linearised around the steady state mean flow and formulated versus perturbation variables. For computational purposes, the unbounded spatial domain must be truncated and then suitable absorbing boundary conditions are introduced. Difficulties arise mainly from the great difference between properties of the inner water and the water surface. Singularities appear at the intersection between the boundaries of the domain and air-fluid interface. Very different dynamical responses are noticed according to whether the excitation is located close to the free surface. Numerical illustrations of these results are given and commented.

Keywords: water waves, absorbing boundary condition, fluid-structure interaction, numerical instabilities.

AMS Classification: Primary: 74F10, 35L85, 35R35; Secondary: 76B15, 35L70, 35Q35

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