THE SUBCRITICAL MOTION OF A SEMISUBMERGED BODY : SOLVABILITY OF THE FREE BOUNDARY PROBLEM

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Abstract

We discuss existence, and regularity of the solutions of the wave-resistance problem for a thin semisubmerged body moving at uniform subcritical velocity in a heavy fluid (e.g. water) of constant depth. The main assumption (on the geometry of the body) is that the flow is two-dimensional, i.e. it can be completely described in the vertical plane containing the direction of the motion. Then, the problem can be formulated in terms of a boundary value problem for a holomorphic function (the complex velocity field) satisfying a non linear condition (the Bernoulli condition) on a free boundary (the free surface of the fluid). By a hodograph transformation, and choosing an appropriate functional setting, we first reduce the problem to the resolution of a nonlinear functional equation depending on two unknown parameters, which are related to the positions in the hodograph plane of the points of contact between the free surface and the body. The main result of this paper is the proof of the existence, under mild assumptions on the body's profile, of an exact solution of the nonlinear problem : the resulting free surface is asymptotically flat at infinity upstream and is oscillating downstream; moreover, it is tangent to the profile of the body's section at the contact points.