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MOTION OF THIN PLATES IN A VISCOUS FLUID IN THE STOKES APPROXIMATION

Abstract

Motion of plane wings in fluid, gas and rarefied media is of keen interest for aerospace applications. The paper is aimed at developing methods for lift and drag forces estimates for thin plate's motion in fluids, which is relevant to describing plane wings motion in fluid, gas and rarefied media. The present paper develops solutions for 3-D problems accounting for effects of viscosity in streaming flows of rigid impermeable and partially permeable plates. One of the models of hydrodynamics is the Stokes approximation. The presented work examines the problems of the motion of thin bodies in a viscous incompressible fluid. In the Stokes approximation, the equations of motion are linear. This allows the use of fundamental solutions to reduce the motion of thin bodies of finite size to singular integral equations. The paper proposes a numerical method for solving the obtained integral equations for the three-dimensional motion of bodies in the form of a set of thin impermeable and permeable plates (not the direct boundary element method). In this method, the solution to the problem is obtained in the form of a finite series expansion in terms of the found basic functions. Despite the rather severe restrictions on the applicability of the Stokes model (small Reynolds numbers), there are quite large areas of application of this kind of problems in the aeromechanics of rarefied gases, in the hydrodynamics of creeping flows and biohydrodynamics..
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