THREE-DIMENSIONAL SUBSONIC FLOWS, AND ASYMPTOTIC ESTIMATES FOR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS

BY

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1. Introduction

During the past half century there has occurred a series of striking advances in the mathematical theory of compressible irrotational fluid flow in two dimensions. These developments have been concomitant with discoveries of general mathematical interest and to some extent with the growth of new mathematical disciplines. Among these we may cite the hodograph transformation of Chaplygin [3], the use of function-theoretical properties of quasi-conformal mappings [1, 6, 15], the theory of regular variational problems [19, 20], potential-theoretic investigations [7], the development of fixed point theorems in function space [11, 16], and the theory of pseudo-analytic functions [2].

Since most of these methods are by their nature limited in application to two-dimensional phenomena, the theory of three-dimensional flow has not fared so well, and there seems to be little literature of a precise mathematical character on the subject. There appear, in fact, to be serious difficulties in the way of a comprehensive discussion, for the study of such flows is equivalent to the study of a non-linear second order equation in three independent variables, and the problem of finding