

*Discontinuous Initial Value Problems for Symmetric Hyperbolic Linear Differential Equations**

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INTRODUCTION

Discontinuous solutions of hyperbolic partial differential equations have often been treated in the mathematical literature. The earlier treatments dealt mainly with second order equations (see e.g. [1], [2]). Recently R. COURANT & P. D. LAX [3] extended the theory to first order linear hyperbolic systems and proved an existence theorem for discontinuous solutions of initial value problems. In this paper we generalize the theory of COURANT & LAX in two respects. First, we consider more general equations. This generalization is not without interest for it permits the inclusion of some important equations of mathematical physics.† Second, we consider initial-boundary value problems rather than pure initial value problems.

In Part II our theory will be applied to the study of asymptotic expansions of solutions of certain partial differential equations.

1. Initial value problems for symmetric hyperbolic equations. Let u be a k component vector function of the $n + 1$ variables x_0, x_1, \dots, x_n (u may be thought of as a row or column matrix, according to the context in which it appears). Let A and B denote $k \times k$ matrices with real entries. We will sometimes denote x_0 by t (since in physical problems it may represent time) and the "space variables" x_1, \dots, x_n by x . The matrices A and B are taken to be

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†That the present theory is directly applicable to Maxwell's equations will be demonstrated in *Asymptotic Expansion of Steady-State Solutions of Symmetric Hyperbolic Linear Differential Equations*. This paper appears in the present issue and will be referred to as Part II.