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Mixed Problem for Hyperbolic Equations of Second Order in a Domain with a Corner

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Introduction

We consider the mixed problem for hyperbolic equation of second order in domains $\{(t, x, y) \mid t>0, x>0, y>0\}$ and $\{(t, x, y, z) \mid t>0, x>0, y>0, z>0\}$. In [4], Kupka and Osher treated the mixed problem for wave equation with zero initial data in a multi-dimensional corner $\{(t, x_1, \cdots, x_n) | t>0, x_k>0 \ (k=1, \cdots, n)\}$. Also, in [1], Kojima and Taniguchi considered the mixed problem for wave equation in a domain $\{(t, x, y) \mid t>0, x>0, y>0\}$, got the semi-group estimate and proved the existence of the classical solution. At that time, boundary operators had constant coefficients. The purpose of this paper is to generalize the results in [1] and [4].

When we treat the mixed problem for hyperbolic equation in a domain with smooth boundaries, we can prove the existence of the classical solution using the energy inequality and functional analysis. But, for the mixed problem in a domain with edges and corners, it seems that we can not yet show the existence of the classical solution by use of the energy inequality and functional analysis. Improving the method in [1], we get the energy inequality and prove the existence of the classical solution for the mixed problem in domains $\{(t, x, y) \mid t>0, x>0, y>0\}$ and $\{(t, x, y, z) \mid t>0, x>0, y>0, z>0\}$. The method used in [1] to obtain the energy inequality was that we transformed the mixed problem for wave equation into the one for symmetric hyperbolic system of first order under the boundary condition which was positive definite on one face of the boundary and non-negative on another one. We treated 2×2 or 3×3 hyperbolic system of first order for wave equation in [1]. To use the above method and consider the mixed problem for wave equation with any lower order term of variable coefficients and further a boundary operator of variable coefficients, we concern with $N\times N(N\geqq 4)$

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