

About a class of nonlocal hyperbolic equations

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Abstract. Layers with material properties which significantly differ from those of the surrounding medium appear in a variety of applications. The layer may have a structural, thermal, electromagnetic or optical role, etc. The processes in domains with layers can be modelled by boundary value problems whose solutions are defined in two or more domains. In some cases these domains are disconnected. The effect of the intermediate region can be taken into account by means of nonlocal conjugation conditions. In this paper we investigate an initial boundary value problem for a one-dimensional hyperbolic equation in two disconnected intervals. In each interval an initial-boundary problem of hyperbolic type with Robin boundary condition is given, while the interaction between their solutions is described by means of nonlocal conjugation conditions. For the model problem the existence and uniqueness of its weak solution in appropriate Sobolev-like space is proved. A finite difference scheme approximating this problem is proposed and analyzed. An estimate of the convergence rate has been obtained. The problem of eigenvalues has also been considered. Theoretical results have been covered by numerical experiments.

Keywords: weak solution, Sobolev spaces, conjugation condition, finite-difference scheme, eigenvalue.

References

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