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ON THE UNIQUENESS OF SOLUTION FOR ONE-DIMENSIONAL NON-SELF-ADJOINT MIXED PROBLEM FOR SECOND ORDER SEMILINEAR HYPERBOLIC EQUATIONS

Abstract

It is known that many problems of physics, hydromechanics, theory of plasticity, mechanics of continua, relativistic quantum mechanics, theory of elasticity and mathematical physics are reduced to the study of mixed problems for hyperbolic equations. Special cases of such equations appear when studying transversal motion of extendible beam, structurally damped nonlinear oscillations of string or of beam, dynamical stability of elastic bodies, etc.

Mixed problem for linear hyperbolic equations has been studied in the works of Z.I. Halilov, O.A. Ladizhenskaya, Y.B. Lopatinski, T. Kato, M.I. Vishik, Y.F. Karabeynik, B.M. Levitan, V.A. Ilyin, Y.A. Mamedov, B.A.I skenderov, N.I. Brish, I.N. Valeshkevich, H.O. Kreis, T. Sirota, K. Asano, M. Ikawa, R. Sakamoto, W. von Wahl and many others. As for one-dimensional and multi-dimensional mixed problems for nonlinear hyperbolic equations, they have been studied in the works of L.Lichtenstein, M.R.Siddiqi, Y.Schauder, M. Krzizanski, U. Barbutti, F.E. Brauder, J.-L. Lions, W. Strauss, I.E. Seagal, J. Sather, D.H. Sattinger, M. Walk, A. Doctor, S.I. Pohozhayev, Y.A. Dubinski, A.I. Huseynov, Y.J. Mamedov, H.I. Chandirov, K.I. Khudaverdiyev, S.Y.Yagubov, A.B. Aliyev, V.K. Kalantarov, K.K. Hasanov, Y.R. Bahshaliyev, B.O.Tahirov, H. Pecher, W. von Wahl, P. Brenner, F.K. Khudaverdiyev, I.G. Namazov and many others.

This work is dedicated to the study of uniqueness of almost everywhere and classical solutions of one-dimensional mixed problem with Ionkin type non-self-adjoint boundary conditions for second order semilinear hyperbolic equations of the following form:

$$u_{tt}(t, x) - u_{xx}(t, x) = F(t, x, u(t, x), u_t(t, x), u_x(t, x)),$$

where $0 \leq t \leq T < +\infty$, $0 \leq x \leq 1$, F is a given function, and $u(t, x)$ is a sought function. Bellman- Gronwall inequality is used to prove the theorems of uniqueness for almost everywhere and classical solutions of mixed problem under consideration.