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About unique solvability of boundary value problem for systems of hyperbolic equations with impulsive effect

The boundary value problem for system of hyperbolic equations in partial derivative from two independent variables with impulsive effect is considered on $\bar{\Omega} = [0, T] \times [0, \omega]$

$$\frac{\partial^2 u}{\partial t \partial x} = A(t, x) \frac{\partial u}{\partial x} + B(t, x) \frac{\partial u}{\partial t} + C(t, x)u + f(t, x), \quad (1)$$

$$u(t, 0) = \psi(t), \quad t \in [0, T], \quad (2)$$

$$P_0(x) \frac{\partial u(0, x)}{\partial x} + S_0(x) \frac{\partial u(T, x)}{\partial x} = \varphi_0(x), \quad x \in [0, \omega], \quad (3)$$

$$P_i(x) \frac{\partial u(t_i - 0, x)}{\partial x} - S_i(x) \frac{\partial u(t_i + 0, x)}{\partial x} = \varphi_i(x), \quad i = \overline{1, m}, \quad (4)$$

where $u \in R^n$, $(n \times n)$ - matrices $A(t, x)$, $B(t, x)$, $C(t, x)$, n - vector-function are continuous on $\bar{\Omega}$, $(n \times n)$ - matrices $P_i(x)$, $S_i(x)$, n - vector-function $\varphi_i(x)$, $i = \overline{0, m}$, are continuous on $[0, \omega]$, n - vector-function $\psi(t)$ is continuously differentiable on $[0, T]$.

The solution to problem (1)-(4) we will call a piecewise continuous on Ω function $u(t, x)$, having the piecewise continuous on Ω partial derivatives $\frac{\partial u(t, x)}{\partial x}$, $\frac{\partial u(t, x)}{\partial t}$, $\frac{\partial^2 u(t, x)}{\partial t \partial x}$ satisfying to system (1) at any $(t, x) \in \Omega$, except lines $t = t_i$, $i = \overline{0, m}$, meets the boundary conditions (2), (3), and condition of impulsive effect in fixed moments time (4).

We investigate questions of the existence, uniqueness and finding solutions of the problem (1)-(4). Sufficient conditions for existence of solutions periodic in t with period T for systems of partial integro-differential equations with an impulsive effect were established by numerical-analytic method [1]. The non-local boundary value problem with data on characteristics for system of hyperbolic equations without integral summand were considered in [2-4] by the method introduction of functional parameters.

In the present communication the sufficient coefficients conditions of the unique solvability of the boundary value problem for system of hyperbolic equations (1)-(4) are obtained and algorithm finding its solution are proposed.

References

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