Algorithm of finding of a solution bounded on stripe of linear hyperbolic equation with the mixed derivative

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Abstract: A semiperiodic boundary value problem is examined for linear hyperbolic equation with two independent variables. Euler's modification broken method is offered for construction of a solution bounded on a stripe. The conditions of existence of a solution bounded on a stripe are received.

We consider a linear hyperbolic equation with two independent variables

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

where $A(x,t), B(x,t), C(x,t)$ are functions continuous on $\overline{\Omega}$, $f : \overline{\Omega} \times R^3 \to R$, is function continuous on $t \in \mathbb{R}$ at fixed $x \in [0,\omega]$ and uniformly relatively $t \in \mathbb{R}$ continuous on $x \in [0,\omega]$.

The solution of equation (1) is investigated satisfying to the following conditions

$$u(0,t) = \psi(t), \quad t \in \mathbb{R} = (-\infty,\infty), \quad \frac{\partial u(x,t)}{\partial x} \in C^*(\overline{\Omega},\mathbb{R}), \tag{2}$$

where $C^*(\overline{\Omega},\mathbb{R})$ a space of bounded functions, the continuously differentiable function $\psi(t)$ is bounded on $\mathbb{R}$ together with the derivative $\dot{\psi}(t)$. The problem (1), (2) we will reduce to the equivalent problem, entering new unknown functions $v(x,t) = \dfrac{\partial u(x,t)}{\partial x}$, $w(x,t) = \dfrac{\partial u(x,t)}{\partial t}$. For finding bounded on a stripe solution we apply Euler's modification broken method [1] and we get a problem for the systems ordinary differential equations. Unlocal boundary value problems are built for equation (1) on a finite area, allowing with set to approximate narrowing exactness on this area of bounded on the stripe solution.

Keywords: linear hyperbolic equation, boundary value problem, Euler's modification broken method, solution bounded on a stripe

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References

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