On multiperiodicity and almost periodicity of the solutions of boundary value problem for system of parabolic type equation

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Abstract: Consider the linear parabolic type equation with multivariate time

$$Lu \equiv \frac{\partial u}{\partial \tau} + \sum_{j=1}^{m} \frac{\partial u}{\partial t_j} - \Delta u - \frac{\partial^2 u}{\partial y^2} + \gamma u = f(\tau, t, x, y)\,, \qquad (1)$$

where $(\tau, t) \epsilon E_{1+m}$ - space of time variable, $y \in E_1^+ = [0, +\infty)$, $E_n - n$ - measure Euclid space of vectors $x = (x_1, x_2, .., x_n)$; $\gamma = const > 0$;
$\Delta = \frac{\partial^2}{\partial x_1^2} + \frac{\partial^2}{\partial x_2^2} + \cdots + \frac{\partial^2}{\partial x_n^2}$ –Laplace operator; $f(\tau, t, x, y)$ – set function.
Assume that the $f(\tau, t, x, y)$ has (θ, ω) - periodicity on τ, t and almost periodic on x with ε - almost period ϑ even with respect to y, also satisfying on τ, t and x, y condition of Gelder with exponents $\frac{\alpha}{2}$ and $\alpha \in (0,1)$ accordingly.

Problem. Find sufficient conditions of existence and uniqueness multi periodical on τ, t and almost periodic on x solution of parabolic type equation (1), which satisfy boundary condition

$$u(\tau, t, x, 0) = \Psi(\tau, t, x), \qquad (2)$$

where function $\Psi(\tau, t, x)$ - (θ, ω) - periodic on τ, t and almost periodic on x. Among of the boundary value problem which is setting all along the space, considerable interest represents half-space boundary value problem which bring to study periodic and almost periodic solutions of parabolic equation [1], [2].

Developing idea of work [3] is finding some condition of quality bound with multi periodicity and almost periodicity of variable part of the fundamental solution and getting sufficient conditions of existence and uniqueness of multi periodicity on τ, t and almost periodicity on x solution of the first boundary value problem (1) – (2).

Keywords: multi periodic, almost periodic, parabolic, multivariate time.

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