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ON THE NONSTATIONARY POUSELLE SOLUTION

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In the bounded domain $Q_T = \Omega \times \Delta_T$ with $\Omega \subset \mathbb{R}^2, \Delta_T = (0,T)$ we consider such problem:

$$v_t - \Delta v = f(t), \quad x \in Q_T,$$

$$v|_{\partial\Omega} = 0, \quad v(x,0) = 0,$$

$$\int\limits_{\Omega} v(x,t)\, d\tau = F(t),$$

where $F(t)$ is given. Such problem is transformed in integral Volterra equation of second kind

$$f^{(N)}(t) - \frac{1}{\varkappa_N} \sum_{k=1}^{N} \beta_k^2 \lambda_k \int\limits_0^t \exp(-\lambda_k (t-\tau)) f(\tau)\, d\tau = \varphi^{(N)}(t),$$

where

$$\varkappa_N = \sum_{k=1}^{N} \beta_k^2, \quad \varphi^{(N)}(t) = \frac{1}{\varkappa_N} F'(t).$$

Existence and uniqueness of solution $f(t)$ in continuous and Hölder function spaces is proved. Also is proved that $v(x,t) \in \mathbf{W}_2^{1,1}$, where $\mathbf{W}_2^{1,1}$ is Sobolev space. Also such results is get for periodic initial conditions: $u(x,0) = u(x,T)$ and $f(0) = f(T)$, with some $T > 0$.