AL-FARABI KAZAKH NATIONAL UNIVERSITY

ABSTRACTS

OF THE THIRD CONGRESS OF THE WORLD MATHEMATICAL SOCIETY OF TURKIC COUNTRIES

June 30 - July 4, 2009

Volume 1

Edited by Academician Bakhytzhan T. Zhumagulov

Almaty
«Қазақ университеті»
2009

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ON THE SOLVABILITY OF ONE MODEL PROBLEM

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Let $D_1 = \{x \mid x' \in R^{n-1}, x_n < 0\}$, $D_2 = \{x \mid x' \in R^{n-1}, x_n > 0\}$, $D_T^{(m)} = D_m \times (0,T)$, $m = 1,2$, $R_T = \{(x,t) \mid x' \in R^{n-1}, x_n = 0, 0 < t < T\}$.

It is required to find functions $u_1(x,t)$, $u_2(x,t)$ and $\rho(x',t)$ satisfying the following equations and conditions

$$\partial_t u_m - \sum_{i,j=1}^{n} a_{ij}^{(m)} \partial_{x_i x_j}^2 u_m = f_m(x,t) \quad \text{in} \quad D_T^{(m)}, m = 1,2,$$

$$u_m\big|_{t=0} = 0 \quad \text{in} \quad D_m, m = 1,2, \qquad \rho\big|_{t=0} = 0,$$

$$u_1 - u_2\big|_{R_T} = \varphi_1(x',t), \; b\nabla u_1 - c\nabla u_2\big|_{R_T} = \varphi_2(x',t),$$

$$\beta \partial_t \rho - \alpha \sum_{l,p=1}^{n-1} d_{lp} \partial_{x_l x_p}^2 \rho + l_0 u_1\big|_{R_T} = \varphi_3(x',t),$$

where $b = (b_1, \ldots, b_n)$, $c = (c_1, \ldots, c_n)$ - vectors, $\alpha, \beta, a_{ij}^{(m)}, b_i, c_i, d_{lp}, l_0$, $m = 1,2$, $i,j = 1,\ldots,n$, $l,p = 1,\ldots,n-1$, - constant coefficients, and $\alpha > 0$, $\beta > 0$, $b_n > 0$, $c_n > 0$.

The problem in the Sobolev spaces $W_q^{l,\frac{l}{2}}(D_T)$, $1 \le q < \infty$, l - noninteger, is studied.

Theorem. For any functions $f_m \in L_q(D_T^{(m)})$, $m = 1,2$, $\varphi_2 \in W_q^{1-\frac{1}{q}, \frac{1}{2}-\frac{1}{2q}}(R_T)$, $\varphi_1, \varphi_3 \in W_q^{2-\frac{1}{q}, 1-\frac{1}{2q}}(R_T)$ either of the problem has unique solution $u_m \in W_q^{2,1}(D_T^{(m)})$, $m = 1,2$, $\rho \in W_q^{4-\frac{1}{q}, 2-\frac{1}{2q}}(R_T)$ and this solution satisfies the estimate

$$\sum_{m=1}^{2} \| u_m \|_{q,D_T^{(m)}}^{(2)} + \| \rho \|_{q,R_T}^{(4-\frac{1}{q})} \le$$

$$\le C_1 \left(\sum_{m=1}^{2} \| f_m \|_{q,D_T^{(m)}} + \| \varphi_1 \|_{q,R_T}^{(2-\frac{1}{q})} + \| \varphi_2 \|_{q,R_T}^{(1-\frac{1}{q})} + \| \varphi_3 \|_{q,R_T}^{(2-\frac{1}{q})} \right).$$

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