



V Congress of the  
**TURKIC WORLD MATHEMATICIANS**  
Kyrgyzstan, «Issyk-Kul Aurora», 5-7 June, 2014



# ABSTRACTS

Bishkek - 2014

11	Aliev N., Aliev F., Guliev A., Ilyasov M., Mammadova Y. (Azerbaijan) Series method of rotation of a boundary value problem for the system of hyperbolic equations arising in oil production	158
12	Aliev N., Guliyev A., Tagiyev R., Gasimova K. (Azerbaijan) Existence and uniqueness of solution of the boundary value problem describing by the system of hyperbolic equations	159
13	Amangaliyeva M., Jenaliyev M., Imanberdiyev K., Ramazanov M. (Kazakhstan) About one inverse problem for the heat equation	160
14	Amangaliyeva M., Jenaliyev M., Kosmakova M., Ramazanov M. (Kazakhstan) On unique solvability of the boundary value problem for heat equation	161
15	Ananjeva J. (Kyrgyzstan) Approximate solution of the Kortevveg-De Vries type equation by additional argument method with strongly nonlinear right part	162
16	Aripov M., Sadullaeva Sh. (Uzbekistan) To investigation of solutions of double degenerate parabolic system with variable coefficients	163
17	Asanova A. (Kazakhstan) On nonlocal boundary value problem with integral condition for quasilinear hyperbolic equation	164
18	Ashirbaeva A. (Kyrgyzstan) Peculiarities of method of additional argument for equations of higher order	165
19	Ashirbaeva A., Mamaziyaeva E. (Kyrgyzstan) Investigation of solutions of partial operator-differential equations of the second order by the method of additional argument	166
20	Ashirbaeva A., Mambetov J. (Kyrgyzstan) Using the method of the additional argument for system of integro-differential equations	167
21	Avdonin S. (USA), Nurtazina K. (Kazakhstan) Source identification for the heat equation with memory	168
22	Berdyshev A. (Kazakhstan), Karimov E. (Uzbekistan) On the uniqueness of the inverse problem for time-fractional mixed type equation	169
23	Burenkov V. (United Kingdom), Tararykova T. (Kazakhstan) The Hardy operator in Morrey-type spaces	170
24	Burova E. (Kyrgyzstan) Solving of Burgers equation by the additional argument method	171
25	Danaev N., Daribaev B. (Kazakhstan) An iterative algorithm for numerical solution of heat convection equations	172
26	Danaev N., Tursynbay A., Urmashiev B. (Kazakhstan) The numerical solution of Navier-Stokes equations for the incompressible viscous liquid with "speed-pressure" variables in three-dimensional space	173
27	Dzhobulayeva Zh. (Kazakhstan) On a boundary problem for the system of parabolic equations with the small parameters	174
28	Egemberdiyev Sh. (Kyrgyzstan) Reductions of the system of partial differential equations with initial-boundary values description to systems of integral equations by means of an additional argument	175
29	Gadjiev T., Sadykhova N. (Azerbaijan) Removable singularities of solutions of degenerate nonlinear elliptic equations on the boundary of domain	176
30	Iakimanskaia T., Skliar S. (Kyrgyzstan) An adaptive numerical method for nonlinear nonstationary convection-diffusion problems	177

## AN ITERATIVE ALGORITHM FOR NUMERICAL SOLUTION OF HEAT CONVECTION EQUATIONS

Nargozy Danaev, Beimbet Daribaev

Almaty (Kazakhstan)

Nargozy.Danaev@kaznu.kz, beimbet.daribaev@gmail.com

The report focuses on the numerical solution of stationary differential problems in the region  $D = \{0 < x_\alpha < 1, \alpha = 1, 2\}$  for two-dimensional heat convection equations can be written in the following form [1]:

$$\left(\omega \frac{\partial \psi}{\partial x_2}\right)_{x_1} - \left(\omega \frac{\partial \psi}{\partial x_1}\right)_{x_2} = \frac{1}{Re} \Delta \omega - \frac{Gr}{Re^2} \frac{\partial \theta}{\partial x_1} + f(x_1, x_2), \quad (1)$$

$$\Delta \psi = \omega, \quad (2)$$

$$\left(\theta \frac{\partial \psi}{\partial x_2}\right)_{x_1} - \left(\theta \frac{\partial \psi}{\partial x_1}\right)_{x_2} = \frac{1}{Pr Re} \Delta \theta + g(x_1, x_2), \quad (3)$$

here  $Pr$  - Prandtl number,  $Re$  - Reynolds number,  $Gr$  - Grashof number,  $\Delta$  - Laplace operator.

Considered an iterative algorithm of the type of variable directions, using by conducting auxiliary function of the vorticity with homogeneous boundary values in the following form:

$$\frac{\omega^{n+\frac{1}{2}} - \omega^n}{\tau} + L_{h,\psi}(\omega^n) \psi^{n+\frac{1}{2}} = \frac{1}{Re} \Delta_h \omega^n - \frac{Gr}{Re^2} \theta_x^n + \rho_h \psi^{n+\frac{1}{2}} + f_h, \quad (4)$$

$$\Delta_h \psi^{n+\frac{1}{2}} = \omega^{n+\frac{1}{2}}, \quad (5)$$

$$\frac{\omega^{n+1} - \omega^{n+\frac{1}{2}}}{\tau} = \frac{1}{Re} \Delta_h (\omega^{n+1} - \omega^n), \quad (6)$$

$$\Delta_h \psi^{n+1} = \omega^{n+1}, \quad (7)$$

$$L_{h,\theta}(\psi^n) \theta^{n+1} = \frac{1}{Pr Re} \Delta_h \theta^{n+1} + g_h, \quad (8)$$

here  $L_{h,\psi}, L_{h,\theta}$  - symmetric differential operators corresponding to the approximation of the convective terms in the equations of motion and temperature,  $\rho_h > 0$ .

An iterative algorithm of variational type minimal corrections for implementation of auxiliary non-self-adjoint grid equations was considered [2]. On example of the differential problem with boundary conditions:

$$\begin{aligned} x_1 = 0, 1; \quad 0 \leq x_2 \leq 1 : \psi = \frac{\partial \psi}{\partial x_1} = 0, \quad \theta = x_2, \\ 0 \leq x_1 \leq 1, \quad x_2 = 0 : \psi = \frac{\partial \psi}{\partial x_2} = \theta = 0, \quad 0 \leq x_1 \leq 1, \quad x_2 = 1 : \psi = \frac{\partial \psi}{\partial x_2} = \theta = 1, \end{aligned}$$

discussion of the calculation result and software implementation details of the algorithm on a multi-processor cluster was conducted.

### REFERENCES

- [1] Rouch P. (1980) Vychislitel'naya gidrodinamika. "Mir", Moskva, 616 p.
- [2] Samarskiy A.A., Nikolaev E.S. (2004) Metody resheniya setochnykh uravneniy. "Nauka", Moskva, 592 p.

---

Work performed under the grant 0696/GF Science Committee, MES