Abstracts of MMA2009, May 27 - 30, 2009, Daugavpils, Latvia


# MATHEMATICAL MODELLING OF 2D MAGNETOHYDRODYNAMICS AND TEMPERATURE FIELDS, INDUCED BY ALTERNATING CURRENT FEEDING ON THE BAR TYPE CONDUCTORS IN A CYLINDER

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The heating of buildings by ecologically clean and compact local devices is interesting and actual problem . One of the modern areas of applications developed during last years is effective use of electrical energy produced by alternating current in production of heat energy. This work presents the mathematical model of one of such devices.

In papers [1; 2; 3; 4] we had modelled cylinder form electrical heat generators with six or nine circular conductors - electrodes. In this work we analyze different type of conductors. They have forms of bars and they are placed parallel to the cylinder axis in the electroconductive liquid. Let the cylindrical domain $\Omega = \{(r, \phi, z) : 0 < r < R, 0 \leq \phi \leq 2\pi, -\infty < z < \infty\}$ , where $R$ is the radius of the cylinder. The alternating current is fed to $N$ infinite discrete conductors of forms of bars, which are placed parallel to the cylinder axis in the liquid in the domain $r < r_0 < R$.

In the weakly conductive liquid-electrolyte the current creates the radial $B_r(r, \phi)$ and the azimuthal $B_\phi(r, \phi)$ components of the magnetic field as well the axial component of the induced electric field $E_z(r, \phi)$, which, in its turn, creates the radial $F_r(r, \phi)$ and azimuthal $F_\phi(r, \phi)$ components of the Lorentz' force.

For the calculation the electromagnetic fields outside the electrodes, the averaging method over the time interval $2\pi/\omega = 1/f$ is used. The averaged values of electromagnetic force $< F_r(r, \phi) >$, $< F_\phi(r, \phi) >$ give rise to a liquid motion, which can be described by the stationary Navier-Stokes equation in the ring $r_0 < r < R$ .

The 2D averaged magnetic field, source terms for the tempeature and Lorenz' forces, induced by alternating current with 3, 6 and 9 bar type electrodes are calculated in cross-section of cylinder by computer program MATLAB. With the finite difference method the distributions of magnetohydrodynamics flows and maximal temperature depending of the connections of electrods are obtained.

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