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HEAT FLUX DENSITY AS THE MAIN VECTOR IN THERMAL CONDUCTIVITY PROBLEMS

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ABSTRACT

The advantages of boundary conditions of the second kind in the problems of thermal conductivity and the method of presenting the results of analytical or research work in the form of heat flux density not as a product of the driving force of the process and resistance, but their ratio are shown. For the first time an analogue of the vector Terms for temperature fields – the vector of heat flux density was found. A brief overview of the development of thermometry in Ukraine and the transit calorimetry on its basis is presented. For closed-type calorimeters, recommendations are given for their design and fabrication using the Gauss-Ostrogradsky theorem, which relates the integral flow of a continuously deferenced vector field through a closed surface and the integral of the divergence of this field over the volume bounded by this surface. The Gauss's theorem for a isothermic-shell calorimeter (ISC) states that the total heat flux through its surface and the heat release or absorption capacity in the substance of the sample in the shell are the same, even if these fluxes are non-uniform over the surface and in the volume. The development of heat meters as small-sized, low-inertia sensors of heat flux density allowed the creation of thermal calorimeters-shells which common feature is the combination of the functions of the shell and calorimeter system. Operation of various types of ISC has confirmed their advantages over other calorimeters, namely: ISC shell has a small thermal resistance and inertia compared to the resistance and inertia of the sample, which allows to correctly study nonstationary processes; the calibration process is greatly simplified; the temperature differences are not measured at all; there is no need for differential measurements with a comparison sample etc.