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GRID METHOD FOR SOLVING PROBLEMS OF THERMOPHYSICS

One example of such problems can be the problem of crystallization (solidification) of metal in the process of continuous casting on continuous casting machines. Depending on the temperature value, the values of thermophysical param-

ters of steel change significantly. The difficulty arising in solving this kind of problems is the necessity to apply a fine grid to the whole solution area.

It is been proposed to calculate coordinates with given temperature at each step of time iterations, i.e. to find isotherms with given step by temperature values.

If a function $u(x, t)$ is the solution of the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ under some boundary and initial conditions, therefore the expression $u(x_i, t) = u_i = \text{const}$ is implicit equation of the i -th isotherm, i.e. it corresponds the temperature value u_i .

There are a number of problems where it is necessary to fix only some isotherms, e.g., the problem of solidification and cooling of a continuous sheet ingot. In one-dimensional version, it involves the heat conduction equation:

$$C_M(T)\rho \frac{\partial T}{\partial t} = \frac{\partial}{\partial x} \left[\lambda(\tau) \frac{\partial T}{\partial x} \right], \quad x \in [-s, s],$$

the solution of the last equation is carried out under the following boundary conditions:

$$\pm \lambda \frac{\partial T}{\partial x} \Big|_{\Omega} = \alpha [T_0 - T_a(t)],$$

where Ω – surface of the ingot; T_0 – temperature of the ingot surface; $T_a(t)$ – average of the ingot temperature.

Let us point out isotherms T_l – liquidus temperature and T_s – solidus temperature, and on the section $[T_l, T_s]$ we will build a grid with step h_T , and find the coordinates of the selected isotherms using the described above method. This approach allows to increase the grid step, hence the time coordinate step, which allows to significantly reduce machine time and errors arising during calculations.