A COMPUTER SIMULATION OF THERMAL PROCESSES IN WATER BODIES AT DIFFERENT HYDROMETEOROLOGICAL CONDITIONS

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Water reservoirs is the most widely used type of coolers for large enterprises. Their exploitation often meets considerable problems specific for a particular basin. For small cooling basins the problems are associated with the limitation of power station performance related to a rise of the temperature of water taken off from the reservoir and for large coolers the problems are related to thermal pollution, changes in the ice-thermal regime, hydrophysical and hydrobiological processes, especially in the regions of heated water discharge. Key to the solution of a wide range of technological and ecological problems is getting comprehensive and reliable estimates of the parameters of temperature fields generated by these discharges depending on a set of technological and hydrometereological parameters.

In the present work we carry out numerical investigation of these problems using the example of the Magnitogorsk Iron and Steel Plant. This plant is one of the world's largest steel producers and a leading Russian metals company. Warm channel of this plant discharges warm water in the Magnitogorsk reservoir of the Ural River. The study is performed for different technological and hydrometeorological conditions. Since the vertical temperature distribution in such wastewater reservoirs is highly inhomogeneous, the computations should be performed in the framework of 3D model. To adapt the morphological data in a coordinate-depth format to the capabilities of the mesh generator, the reservoir bottom morphology was represented as a set of simple geometrical objects of some specified resolution, which were then introduced into the task batch file.

A code has been written to produce a batch file for grid generator of the ANSYS Fluent package from the data array describing the reservoir bottom morphology. Thus, the complex geometry of the computational domain is realized. The proposed code is of general character and is applicable to the construction of similar geometries and in other tasks. The results obtained in the calculation are the temperature and velocity fields, characteristics of turbulent pulsations at different velocities and qualitative characteristics of the heated water discharge.

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