grids should satisfy the special requirements. On the one hand, it should provide a sufficient accuracy of calculations. So, the grids for the models with complicated boundaries are constructing using irregular spatial steps and mesh refinement in the featured areas. On the other hand, this increases the calculation time and requires more computational resources.

Today, the world leaders in the field of computer (mathematical) modeling are usually using the finite element mesh. Finite element mesh has several advantages:

1) Universality; the finite element method can be used to solve various problems: heat transfer simulation, mechanical problem, fluid dynamics, etc. This makes a comprehensive analysis possible;

2) Higher boundary approximation accuracy;

3) Deformability; in solving the mechanical problem (and some others) it is important to have the ability to change the calculation mesh considering results of the current iteration. Deformability helps to track the dynamic boundaries.

However, the approximation based on the finite difference method also has a number of advantages:

1) simplicity of software implementation;

2) high computational performance (per node);

3) easy parallel computing (including SIMD architectures).

In this paper we propose the finite-difference calculation mesh for simulation of heat transfer processes occurring in permafrost soils. The estimations showed that for qualitative sampling of soil reference sample area of 1 hectare and a depth of 10 m is required grid consisting of more than 1 million units. The prediction calculation of the thermal conductivity of the soil for 10 years on a grid takes about 10 minutes on a single CPU core.

For modeling of processes taking into account a filtration within the classical Darcy's law is offered the fixed settlement grid based on fictitious areas method. However, the counting duration even for a test example considerably increases.

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CONTROLLED THERMONUCLEAR FUSION

In our work achievements and perspectives aimed to producing controlled thermonuclear reactions of fusion are considered. We remind that fusion is the energy source of the Sun and stars. In the tremendous heat and gravity at the core of these stellar bodies, hydrogen nuclei collide, fuse into heavier helium atoms and release tremendous amounts of energy in the process. As a rule in terrestrial laboratories the following reactions

$$D + T \rightarrow {}^{4}He + \mathrm{N}, \quad D + D \rightarrow {}^{3}He + \mathrm{N}, \quad D + {}^{3}He \rightarrow {}^{4}He + {}^{1}p$$

are investigated as the starting point. In so doing heating and confinement of magnetic field plasma is carried out at relatively low pressure and high temperature. To achieve that the thermonuclear reactors in the form of either tokamaks (toroidal chamber with magnetic coils) or stellarators are used. In both setups the plasma is confined by the magnetic field, but the magnetic field in a tokamak has the shape of a toroidal cord through which electrical current is passed, while in stellarator magnetic field is induced by external coils. The latter is the main difference of the stellarator from the tokamak and that causes a complex configuration of the magnetic field in the stellarator.

The international project ITER (the way – in Latin) is one of the most ambitious energy projects for producing controlled thermonuclear fusion. The idea of the project is to build the world's largest tokamak, that will realize the controlled reaction of fusion at a large-scale for long periods of time, and also use a carbon-free as a source of energy. The ITER will be the first fusion device to test the existing technologies, materials, and physics regimes necessary for the commercial production of fusion-based electricity. The main objectives of the ITER are as follows:

1) to achieve the fusion power of the order of magnitude of 500 MW (the world record for fusion power was held by the European tokamak JET – 16 MW of fusion power);

2) to demonstrate the integrated operation of technologies for a fusion power plant (ITER will bridge the gap between today's smaller-scale experimental fusion devices and the demonstration fusion power plants of the future);

3) to create a deuterium-tritium plasma in which the reaction is sustained through internal heating (fusion research today is at the threshold of exploring a "burning plasma" – one in which the heat from the fusion reaction is confined within the plasma efficiently enough for the reaction to be sustained for a long duration);

4) to test tritium breeding (the world supply of tritium is not sufficient to cover the needs of future power plants and ITER will provide a unique opportunity to test mockup in-vessel tritium breeding blankets in a real fusion environment);

5) to indicate the safety characteristics of a fusion device (one of the primary goals of ITER operation is to demonstrate the control of the plasma and the fusion reactions with negligible consequences to the environment).

The stellarators Wendelstein 7 is the project competing as compared to the ITER. We give basic characteristics of this stellarator and make the final decisions about the contemporary status of the problem concerning the controlled thermonuclear fusion.