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«Modeling heat transfer processes in heating systems for surface of highways»

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Problem statement

- Problem statement
- Increase in adhesion coefficient
- Improving traffic safety
- Modeling of heat transfer processes in hydraulic systems of snow melting
- Study of temperature distribution at various points of the concrete pavement

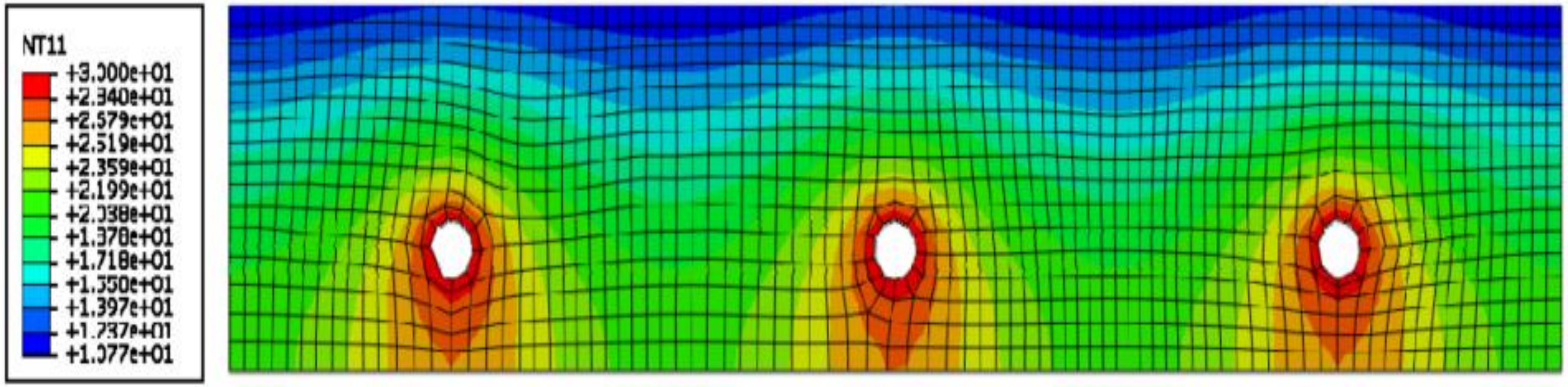
Solution methods

- Methods, algorithms, calculations

The tasks were solved using mathematical modeling, taking into account a number of accepted assumptions. At the same time, a road surface was modeled, in which hydraulic pipes were embedded in a concrete slab, and the heat carrier generated heat energy. To implement the developed model and visualize the results obtained, as well as to analyze the temperature distribution in the concrete pavement, the ABAQUS software package was used. In the calculations, the thickness of the concrete coating was assumed to be 15 cm, the temperature of the coolant was 30 ° C, and the temperature of the environment was 27 ° C.

Solution methods

- Figures



Temperature distribution in a concrete slab when the system is operating 24 hours.

Conclusions

Results, implementation

- The surface temperature distribution is sine or cosine.
- The minimum temperature is located halfway between two adjacent pipes.
- The melting rate at the initial stages is high, and then slows down, since after a heating period, heat transfer gradually passes from a non-stationary state to a steady state.
- There are four stages in the change in surface temperature: the initial stage, the linear stage, the accelerated stage and the stable stage.
- During the accelerated stage, the surface temperature increases exponentially, since the absorbed thermal energy dominates the dissipated energy as a result of convection.
- The simulation model of hydraulic snowmelt can be adequately applied on stationary road objects, the surface of which is not subject to vertical vibrations.
- To use the developed technique when analyzing snow melting on bridge structures, it is necessary to provide for an additional system of water drainage from the road surface.

Contacts

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