

Research Topic:

„Software Development for the calculation of heat transfer of plane structures
using the example of thermo-active seal panels“

Researching Institution:

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in collaboration with

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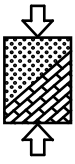
Deutsche Bundesstiftung Umwelt (DBU), Osnabrück

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Aim of the research

The geothermal utilization of the ground with the help of earth-coupled structures forms a future oriented and already approved way to cover the heating demand of buildings. The use of thermo-active seal panels for buildings, which need to be sealed anyway, can improve the cost-effectiveness compared to systems activating only the concrete. In this context, plane structures (especially in flowing ground water) with their large ground-contacting surfaces promise the highest energetic potential.

For rotationally symmetrical systems such as borehole heat exchangers there exist many calculation models. In contrast, until now, there is no existing calculation-model for designing plane thermal-active structures, due to the difference between the physical processes in plane and rotationally symmetrical systems and the implied higher complexity of the contemplated elements.

Within the scope of a research project, which is funded by the DBU (Deutsche Bundesstiftung Umwelt), a new calculation-model describing the heat transfer from plane structures is to be developed using the example of thermal-active seal panels. This model is then to be implemented in an existing simulation software (SHEMAT) and shall be tested for practical application.

Working scheme

The research project is formed as a cooperation of the Chair of Geotechnical Engineering at the RWTH Aachen University and the GEOPHYSICA Beratungsgesellschaft mbH (Aachen). In this context, two main working fields are to be worked on in collaboration during the research project.

In the first working field the new heat transfer module, describing the heat transfer from plane earth-coupled structures, is to be developed using the example of thermal-active seal panels and shall be implemented in the SHEMAT software. SHEMAT is a finite-difference programme, which enables the analysis of coupled mass and heat transfer and has proven its value in various geothermal energy tasks before. When developing the module the physical correlations of the heat transfer from plane structures are to be described separately and to be abstracted for the software implementation. The module will be developed cooperatively, while the software implementation will be carried out mainly by the partner GEOPHYSICA. Theoretical analyses (detailed simulations) as well as large scale laboratory tests are scheduled in order to calibrate and verify the module.

The second working field focuses on the transfer of the theoretical results into practical application. Therefore sensitivity analyses (regarding location, geometry, groundwater condition, etc.) are to be carried out using the new software tool. Finally, recommendations for designing and installing thermal-active seal panels and plane structures in general can be derived.