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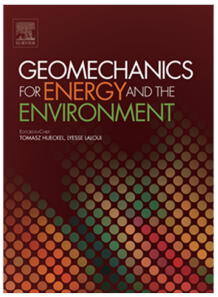

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Thermal Response Prediction of a Prototype Energy Micro-Pile

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Abstract

The paper presents the results of an ongoing research project aimed at developing an innovative technology for energy geostructures for the exploitation of low–enthalpy geothermal energy: the energy micro–piles (EMP). The EMP has the double role of structural support and heat exchanger since it is equipped with a primary circuit of a traditional ground source heat pump system. Given the particular nature of the EMP considered, in terms of pile geometries and characteristics of the primary circuit, its performance has been investigated by means of both field testing, carried out on a full–scale prototype, and 3D finite element simulations. The numerical model has been calibrated on the results of a termal response test carried out on the full–scale prototype. Then, a parametric study has been conducted to gain useful insight on the performance of the EMP under long–term operating conditions, by varying: i) the mass flow rate of the heat–carrier fluid; ii) the soil thermal conductivity; iii) the thermal properties of the circulation pipe. The results of the experimental and numerical activities showed that the value of the specific heat flux generated by the EMP falls in the same range of

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