Numerical modelling of thermo-active shafts

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Abstract

Geotechnical structures, such as foundation piles, retaining walls and tunnel linings, are increasingly employed to produce geothermal energy for space heating and cooling. However, the exchange of heat between the structure and the ground induces additional structural forces and contributes to further structural and ground movements, which may affect the serviceability and stability of such structures. While numerous field and numerical studies exist regarding the response of geothermal piles, no investigations have been carried out to characterise the response of thermo-active shafts. This paper presents a numerical study of the short and long term behaviour of hypothetical thermo-active shafts through fully coupled thermo-hydro-mechanical (THM) finite element (FE) analyses using the Imperial College Finite Element Program (ICFEP), where the effect of changing the structure's geometric characteristics is investigated.