PhD position on Real-time modelling of temperature field around borehole heat exchangers

Université libre de Bruxelles (ULB) and Université de Liège (ULiège), Belgium

This PhD project takes place in the field of closed-loop geothermal energy systems. It will explore the development of modelling tools for the real-time predictions of the temperature field around borehole heat exchangers (BHEs) based on monitoring data collected at the ground source heat pump (GSHP). Such modelling tools can progressively contribute to a more sustainable control of GSHPs of shallow geothermal systems, considering not only the energy demand of the buildings and the geothermal properties of the ground but also the current state of the heat reservoir in the subsurface.

The candidate will (i) analyze monitoring data collected in different geothermal installations at the GSHP and by fiber optics installed along BHEs ; (ii) develop analytical models of heat transfers around BHEs based on the contributions achieved in the research teams involved in the supervision (see Erol et al., 2018; Coen et al., 2021); (iii) develop a methodology to predict the temperature field around BHEs based on the monitoring data and using the analytical models of heat transfers around BHEs.

We seek a candidate with a background in geotechnical engineering, civil engineering, geological/environmental engineering, energy engineering, mechanical engineering or geosciences. The candidate should have an interest in renewable energy. Good mathematical and programming skill is an asset.

The joint thesis will be carried out between Université libre de Bruxelles (ULB – Prof. Gerard) and the Université de Liège (ULiège – Prof. B. François), within the framework of the project EFES (Enhanced flexibility in Energy Systems) funded by the WIN4EX Wallon Region**.**

Both universities offer a dynamic research environment in the field of geotechnical and geoenvironmental engineering, respectively in the Department of Building, Architecture and Town Planning (BATir, ULB - https://batir.polytech.ulb.be/) and the Urban and Environmental Engineering Unit (UEE, ULiège - https://www.uee.uliege.be/). The PhD student will be co-tutored by the two PhD advisers, in a joint PhD program and will benefit from the extensive training proposed by the doctoral schools of both universities.

The position has a duration of 4 years and the PhD is expected to start on 1st September 2024.

Application deadline (detailed resume + motivation letter + names and e-mail addresses of two referees who may be contacted by those in charge of evaluating applications) : 25th May 2024.

Further enquiries on the vacancy and application must be directed to Prof. Pierre GERARD (gerard.pierre@ulb.be)

References

Coen T., François B., Gerard P. (2021) Analytical solution for multi-borehole heat exchangers field including discontinuous and heterogeneous heat loads. Energy & Buildings, 253, 111520.

Erol S., François B. (2018). Multilayer analytical model for vertical ground heat exchanger with groundwater flow. Geothermics, 71, 294-305.