Fundamentals of Energy Geostructures

Professor
Giovanni Ciardi

Email
giovanni.ciardi@unifi.it

Institution
University of Florence

General Information

Energy geostructures are structural elements that exchange heat with the surrounding soil, thereby reducing carbon emissions associated with building heating and cooling, while still fulfilling their primary structural role. This course introduces participants to the fundamentals of energy geostructures from a geotechnical perspective. Starting with linking the climate change with the increasing energy demand of modern society, the principles governing heat and mass transfer in porous media will then be covered. The governing equations of thermo-hydro-mechanical processes and the underlying constitutive assumptions will be presented, followed by an exploration of how non-isothermal processes affect soil behavior. Finally, some practical examples of energy geostructures will be analyzed, with focus on energy micropiles and their applications.

The course will be held online (link for the online meeting room to be provided by the lecturer) and will be given in English.

Schedule

Dates	Description
23/10/2025 – 9.00-12.00	Introduction. Climate change and renewable energies. Geothermal energy. Principles of energy geostructures. Heat transfer modes
24/10/2025 – 9.00-12.00	Principles of heat and mass transfer in porous media. Balance and constitutive equations. Soil thermal properties
30/10/2025 – 9.00-12.00	Effects of temperature on soil behavior and determination of soil thermal properties. Design principles for energy geostructures
31/10/2025 – 9.00-12.00	Energy piles and energy micropiles: design, analysis and construction. Practical examples of finite element modelling of energy piles and micropiles
	Total: 12 Hours - 2.0 Credits

For any information www.indicee.unifi.it - dott-dicea@unifi.it