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EXPERIMENTAL PARAMETER IDENTIFICATION IN THERMO-ACTIVE FOUNDATIONS ASSISTED BY NUMERICAL SIMULATIONS

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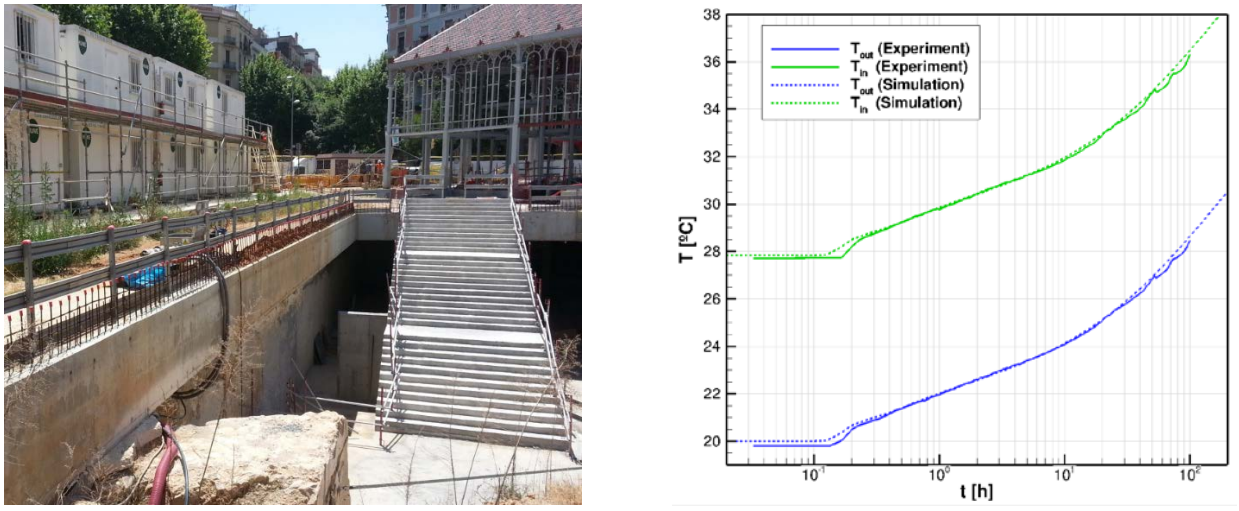
Thermo-active foundations represent the next step in the harnessing of geothermal energy for the sustainable heating and cooling of buildings. By incorporating pipes into the buried structures of a building, heat is exchanged with the surrounding ground, leading to higher efficiencies than with aerothermal systems. Diaphragm walls, used for the construction of basements, represent a typical example of a foundation that can be thermally activated. In order to correctly assess the heat exchange capability of thermo-active foundations, on site experimental characterizations are required. These tests usually consist in the injection of a constant amount of heat during a certain period of time while the inlet and outlet temperatures of the pipes are recorded. Thereafter, a simple theoretical model for the thermal response of the system is fitted to the experimental results, leading to the sought parameter identification. Thermo-active diaphragm walls, however, present a complex geometry not well suited for their effective theoretical modeling. Therefore, in the present work an alternative approach, based on the fitting of a numerical model to the experimental results, is presented. By using simple theoretical models for the thermal response of sub-components of the system, the influence of the different parameters in the overall thermal response of the system is explained, thereby guiding the fitting process to the experimental data. Finally, results are shown for the parameter identification process in a real world thermo-active diaphragm wall constructed in Barcelona, Spain.



(a) (b)

Figure 1: (a) Thermo-active diaphragm wall with external piping connected to the distributor/collector of the geothermal heat exchanger for its experimental characterization. (b) Comparison between experimental and numerical results after the fitting process of the latter ones to the former ones.