Imperial College London

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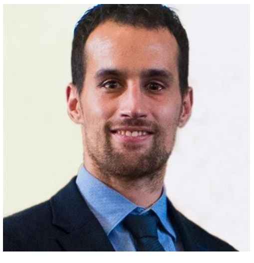
Department of Civil and Environmental Engineering
PhD Seminar Series

Date: Wednesday 14 June 2023, 14:00-15:30
Location: Room 201, Skempton and MS Teams

Chair: Professor Mohammed Quddus



Miguel Martinez Pañeda: Structures Section

"Large mass damping system for tall buildings."

Supervisor: Professor Ahmed Elghazouli

The research investigates a novel integrated damping system, especially suitable for tall buildings, that is able to generate large levels of damping by mobilizing the own mass of the structure as damper mass. Differential movements between the main building and a movable portion of it are controlled by fluid viscous dampers and springs in parallel. Thanks to the large mobilized mass, the system is able to significantly enhance the dynamic behaviour of the building with minimum differential displacements. The proposed arrangement has the potential to bring substantial benefits in terms of enhanced efficiency and resilience for tall building design. As a redundant damping system, the additional damping can be employed to not only reduce wind-induced accelerations but also wind and seismic strength loads, thus allowing significant savings in both superstructure and foundations.

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Pishun Tantivangphaisal: Geotechnics Section

"Constitutive models for sands: reliability and practical application."

Supervisor: Dr David Taborda, Dr Stavroula Kontoe

The quantification of design reliability is a prominent field of research but is rarely seen in practice and seldom applied for complex finite element analyses in geotechnics. The results from these numerical analyses are often assumed to be deterministic, where the more skilled the analyst and the "better" their constitutive model, the more accurate their prediction. One can observe that engineering reliability is commonly quantified where man-made materials are involved (e.g. characteristic strengths of steel and concrete). However, adding the variability and complexities of natural geomaterials to the task of combining data from multiple sources (in-situ, laboratory) to assess reliability is no simple endeavour.
Using field test data available during the large-scale PISA project and monotonic laboratory tests on Dunkirk sand, the calibration of a sand constitutive model is enhanced using Bayesian inference. The model parameters' probability distributions are then fed into Monte Carlo simulations to quantify the reliability of the load-displacement prediction of laterally loaded monopile foundations.

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Yu Luan: Materials Section

"Carbonation-induced corrosion in low CO_2 emission concrete."

Supervisor: Professor Hong Wong, Dr Rupert Myers

Global cement production results in significant carbon dioxide (CO_2) emissions, impeding international efforts towards achieving net-zero by 2050. Low-clinker cements involving the use of high replacement levels of supplementary cementitious materials (SCMs) are one promising solution. However, such cement systems are more prone to carbonation than ordinary Portland cement systems due to the lower calcium content and consumption of $Ca(OH)_2$ by pozzolanic reaction, thereby reducing the pH buffering capacity and potentially leading to increased risk of steel corrosion in concrete structures. This PhD project will study the relationship between the carbonation of low-clinker concretes and steel corrosion kinetics, by understanding the impact of carbonation on pore solution chemistry, moisture retention, and microstructure of bulk matrix and steel-concrete interface (SCI). Thermodynamic modelling and various experimental characterisation techniques will be used to investigate multiple blended systems with high SCMs replacement in order to unlock the full potential of these low CO2 emission concretes while ensuring their long-term durability.