

Five PhD positions at Hong Kong University of Science and Technology (HKUST) for studying tree stability

Project background

Urban greening has been advocated in metropolitan cities worldwide, with the aim to restore ecosystems and 'reclaim the natural environment' within the built environment. Governments have invested billions of dollars in planting trees and building urban forests. However, the increasing intensity of cyclones and hurricanes caused by recent environmental change has led to increasing numbers of tree failures. Existing methods of assessing urban tree risk are qualitative and empirical, relying on tree professionals' experiences to evaluate tree health.

Assessing tree stability under wind is complex and requires cross-disciplinary knowledge of the wind-tree-soil interaction. Funded by the Hong Kong Research Grant Councils (RGC), a cross-disciplinary and cross-institutional team with diverse backgrounds of tree ecology, soil science, wind/structural engineering and geotechnical engineering will combine their expertise to study tree stability problems. **Trees will be viewed as nonlinear, flexible structures subject to dynamic loading, a system that can be analysed quantitatively via engineering principles.** This project will adopt an all-round complementary research methodology, including field testing, physical modelling, numerical modelling and reliability analysis. **We are recruiting five PhD positions of different background to join this cross-disciplinary project:**

Job description, including skillsets required:

PhD post 1: Field and laboratory testing of tree biomechanics and root anchorage

Candidate of this post is expected to conduct *in-situ* tree pull-push over tests to measure root anchorage resistance. He/she is also expected to conduct laboratory testing of biomechanical properties of tree branches, stems and roots using a bespoke testing machine at the HKUST.

Skillsets: *material mechanics, field testing, laboratory testing, applied statistics*

PhD post 2: Biochar improvement of urban soil to tree growth and root anchorage

Candidate of this post is expected to study the physiochemical properties of biochar-amended urban soil, with emphasis to improving tree root growth, penetration and anchorage. Changes in tree health and physiology because of biochar amended should also be studied

Skillsets: *plant biology, plant ecophysiology, soil science, biological/ecological science*

PhD post 3: Physical modelling of soil-root interaction

Candidate of this post is expected to design and conduct geotechnical centrifuge modelling to investigate soil-root mechanical interaction using the 400g-ton beam centrifuge at the HKUST. He/she is also expected to simulate tree pulling tests to evaluate root anchorage behaviour.

Skillsets: *experimental soil mechanics, geotechnical engineering, soil-structure interaction*

PhD post 4: Physical modelling of wind-tree interaction

Candidate of this post is expected to design and conduct instrumented wind tunnel tests to study aerodynamics of trees of different canopy architecture, how tree deformation affects drag force (aka reconfiguration) and the role of soil-root interaction on tree aerodynamics

Skillsets: *Fluid mechanics, aerodynamics, wind engineering, fluid-structure interaction*

PhD post 5: Analytical tree dynamic modelling for reliability-based analysis

Candidate of this post is expected to develop new multi-degree-of-freedom models for capturing tree dynamic behaviour under wind loading. The variabilities of tree properties, soil properties and wind loading will be propagated through the model to evaluate the probability of tree failure.

Skillsets: *structural dynamics, coding, probability/uncertainty, stochastic modelling*

Requirements:

In addition to the background requirements listed under each post, applicants need to have:

- (1) A Bachelor degree (first class honour, or equivalent) or/and master degree;
- * (2) Competent English proficiency (IELTS overall band > 6.5 and TOFEL overall > 90)
- (3) Interest in **collaborative multi-disciplinary research**;
- (4) Able to conduct research work independently yet collaboratively;

**No proficiency test is needed if the bachelor programme is delivered in the medium of English
There is no nationality limit for all positions.*

Studentships:

Successful applicants will be offered a studentship of 3 years (master holder) or 4 years (without master), at a monthly rate of HK\$ 19.5k. They will be enrolled in *HKUST Fok Ying Tung Graduate School* (pg.ust.hk/landing), and they are expected to complete the programme as outlined in the Department of Civil and Environmental Engineering (prog-crs.ust.hk/pgprog/2020-21/mphil-phd-civil%20), in order to earn a PhD degree.

During the study, funding may be provided to attend workshops that are relevant to the research project as well as national and international conferences for disseminating the research findings.

Application:

Interested candidates are invited to send (i) a motivation letter (< 2 pages); (ii) a CV; (iii) proof of English proficiency (valid IELTS/TOFEL certificates); (iv) names of 2 references; (v) copies of bachelor or/and master degrees and transcripts; and (vi) abstract of master dissertation (if any) to the project coordinator, Dr Anthony Leung (ceanthony@ust.hk).

Shortlisted applicants will be interviewed (remotely) by project members. Review of applications will begin immediately and continue until the positions are filled. Starting date is Sep 2021.

Contact: For more information about these positions, please contact the project coordinator:

Dr Anthony Leung; Email: ceanthony@ust.hk

Assistant Professor in Geotechnical Engineering

Associate Director of Geotechnical Centrifuge Facility

Department of Civil and Environmental Engineering, The HKUST

About Department of Civil and Environmental Engineering at the HKUST (www.ce.ust.hk)

The Department has 30 faculty members, teaching about 480 undergraduate students and 200 postgraduate research students. Offering academic degrees in BEng, MSc, MPhil and PhD, we conduct comprehensive teaching and research programmes in basic and applied aspects of civil engineering. The Department is equipped with state-of-the-art research facilities and is ranked consistently among the **top 20** in the world according to the **QS World University Rankings**.