Advanced computational analysis of landslide activity due to extreme natural events

Institution: University of Bath, UK.

Department: Architecture & Civil Engineering

Keywords: Civil Engineering, Computational Mechanics, Landslides, Earthquake Engineering, Finite Element Analysis

Project Description

Landslides are a major natural hazard in many parts of the world and its mitigation presents a global grand challenge. A number of inactive landslides may suddenly become active without any warning due to the occurrence of extreme natural events such as heavy rainfall and earthquakes. Records of recent landslides in Great Britain have been associated with various severe consequences such as damage to civil and transportation infrastructure, economic losses and some reported fatalities.

Although the analysis of large landslides can be considered as a traditional slope stability problem, such an exercise can only predict the initiation of the failure and therefore provide limited information about the post-failure deformations. Even the widely-used finite (FEM) and discrete element methods (DEM) have their own limitations as the former struggle to converge for large deformations and the latter are extremely computationally demanding.

An alternative approach can be the more recently developed Material Point Method (MPM) which seems to be able to overcome a number of obstacles encountered when using the previously-mentioned approaches. This project will involve development of the MPM approach to the analysis of the post-failure behaviour of landslides. Relevant developments in the areas of coupled hydro-mechanical (e.g. seepage) and transient dynamic (e.g. cyclic and earthquake) analysis will allow the formulation of an appropriate tool to assess the post-failure effects of landslides. Comparisons with the more established FEM and its various large-displacement formulations will also allow an assessment of the shortcomings of the latter widely-used methods.

Candidate

This project is entirely computational and will involve numerical analysis with both in-house developed codes and commercial software. Therefore, the suitable candidate should have a strong interest in engineering mechanics, geotechnical/structural modelling and computational analysis. Ideally, the candidate will have some experience in programming using Matlab/C++/Python.

Interested candidates are encouraged to contact the supervisor (Dr Loizos Pelecanos, L.Pelecanos@bath.ac.uk) to inquire about the project.

Funding Notes

Competitively awarded University of Bath studentships are available to support highly qualified UK/EU applicants. This includes a distinction at MSc level or a first class honours undergraduate

Masters degree in engineering or an applied science. The successful candidate will be fully funded for 3.5 years. This studentship will cover their Home/EU tuition fees, a training support fee of £1,000/annum, and a standard tax-free maintenance payment of at least £14,553 (2017-8 rate).

An overseas award can provide tuition fee, £1000 per year Training Support Fee, but no stipend.

The position is located within the Department of Architecture and Civil Engineering at the University of Bath. The department was ranked equal first in the UK out of 45 submissions to Sub-Panel C16 Architecture, Built Environment and Planning in the 2014 Research Excellence Framework. The university is located in southwest England in idyllic Bath, a UNESCO World Heritage Site known for its ancient Roman baths, gothic abbey, and Georgian architecture.

Application Deadline: 15th March 2017

Preferred start date: 2nd October 2017