PhD thesis Proposal

Numerical simulation of wave propagation in realistic 3D basin models and theirs effects on long-period structures response

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The importance of long period motions on the response of large-scale structures (such as high-rise buildings, fluid-storage tanks, suspension bridges, etc.) has been well recognized by the earthquake engineering community. However, such long period motions are usually associated with surface waves, their incorporation in analysis procedures is not systematically performed. Part of this problem is the fact that surface waves are described by more complicated characteristics (e.g. dispersion) that may not be well understood among earthquake engineers. Furthermore, selection of strong motion records containing surface waves with particular characteristics (e.g. Rayleigh waves vs. Love waves) is not a trivial process. Also, techniques to synthesize strong motion records that contain surface waves with particular characteristics, are not widely available. In addition, earthquake engineers are becoming increasingly aware of the importance of rotational motions (i.e. rocking and torsion), associated with long periods, for the dynamic response of long period structures. Analysts develop all the necessary techniques to incorporate rotational motions in the excitation of the structural models, however, recordings of such motions are not always available and their estimation from the records of translational motions, whenever this is feasible, is not an easy task.

This project is concerned about the analysis and modelling of long period motions and their effects on large-scale infrastructures such as high-rise buildings, liquid-storage tanks and long-span bridges. Intense long-period ground motions are usually generated at large distances from the source and consist primarily of surface waves that arise when seismic waves encounter sedimentary deposits. The impact of buried geomorphology on both the elongation of the synthetic motions and the generation of surface waves will be studied. Numerical simulations of wave propagation in a 3D randomly heterogeneous soil basin, embedded in the surrounding outcropping bedrock will be performed. Finally, this work aims to quantifying the impact of surface waves on the performance of long period structures. The developments to generate seismic signals that rigorously describe the presence of basin-generated surface waves, will be used to study the seismic behaviour of large-scale structures through the framework of Performance-Based Earthquake Engineering (PBEE).

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To apply for the PhD :

- It is mandatory to have a Master degree or an equivalent diploma allowing to an application in doctoral school, obtained before October of the current year ;
- **A scientific annex** (not more than 4 pages, free format), written in connexion with the PhD contents and **how you think you could contribute to the project** ;
- A motivated opinion on your PhD application from the supervisor of your Master ;
- A transcript (even temporary) of the grades obtained during your last student year ;
- These documents must be in electronic version, **pdf format only** ;
- The candidates can send their online application **until 15th August, 2019** ;
- Etablissement d'inscription : CentraleSupélec
- Ecole doctorale : SMEMaG de l'université Paris-Saclay