# Thesis Proposal

# Strategy for selecting input ground motion for structural seismic demand analysis

**Scientific Context**

There is today a general consensus in the engineer community that only the analysis of inelastic structural response can give insights into hierarchy of failures, or quantify the energy absorption and force redistribution phenomena resulting from gradual plastic hinge formation in a structure. This analysis requires input ground motion representative of a given earthquake scenario issued by deterministic seismic hazard assessment or by the disaggregation of probabilistic seismic hazard analysis assessment (PSHA). Unfortunately there is no consensus in the earthquake engineering community on how to appropriately generate, select and scale the input ground motion. Moreover if the target is located near an active fault, the seismic ground motion should take into account the source effects affecting the structural response.

We can then mainly distinguish three different kinds of input ground motion:

- Real data (selected for a given scenario, in function of their intensity, or for a target spectrum)
- Spectral matched data (synthetic data issued by the real ones modified to adapt their energy content)
- Synthetic data based on earthquake source physic modeling (recommended for targets located near a seismic source).

**Objectives**

The main goal of the thesis is to quantify the impact of different kinds of input ground motions on the structural demand.

The PhD candidate will handle both real and synthetic ground motions. Real data will be issued from existing worldwide databases following a conditional mean spectrum procedure. Synthetic waveforms will be generated using several techniques spanning from the pure stochastic to hybrid (seismic source based) methods.

The different families of waveforms will be characterized in terms of intensity measures (IM), energy content and time/frequency analysis.

The signals will be inputted in several non-linear structural models (single or multiple degree of freedom) allowing to measure structural demand indicators (i.e. structural drift). The candidate will use the collected elements to define the best strategy for signals selection as a function of the structural analysis goals (determination of median response, vulnerability curve assessment, evaluation of the probability of failure).

**Supervisor: Prof. Philippe GUEGUEN** (ISTerre Grenoble, France).

**Co-supervisor**: **Dr Maria LANCIERI** (IRSN Fontenay aux Roses, France)

**The hosting laboratory:**

The safety of any nuclear installation (reactor, plant, storage, research centre) must be ensured, even in the event of an earthquake on the site. These requirements mean that seismic risk must be

incorporated in the design calculations for installations, and therefore, in the first instance, the characteristics of the earthquakes liable to occur on the sites where they are located must be evaluated. The **B**ureau d'**E**valuation du **R**isque **S**ismique pour la **S**ûreté des **I**nstallations (BERSSIN) is located in Fontenay aux Roses, nearby Paris and it is managed by David BAUMONT. The laboratory hosts undergraduate students, Phd candidates and post-doctoral researchers.
More Infos:
http://www.irsn.fr/EN/Research/Research-organisation/Research-units/environment-unit/BERSSIN/Pages/Seismic-Hazard-Assessment-Section.aspx

**Candidate Profile**:
- Fast track candidates: master degree in earthquake engineering, structural engineering or seismology.
- Candidates with master degree in physics, statistics, signal analysis, geophysics, geotechnical engineering or related fields are also invited to apply.

**Required Documents:**

- Cover letter
- Curriculum Vitae
- Recommendation letter(s) of former supervisors and/or of research managers (if applicable)

If the degree is expected to be obtained within the following months:

- Declaration that the master will be achieved before end of July 2014, signed by the master supervisor.

**Closing date**: June 6, 2014
**Thesis debut**: September 2014

**Contacts:**
Maria LANCIERI maria.lancieri@irsn.fr
Philippe GUEGUEN philippe.gueguen@obs.ujf-grenoble.fr
David BAUMONT david.baumont@irsn.fr