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# Stability assessment of structures under earthquake hazard through GRID technology

F. Prieto Castrillo and M. Boton Fernandez
CETA-CIEMAT (francisco.prieto@ciemat.es)

This work presents a GRID framework to estimate the vulnerability of structures under earthquake hazard. The tool has been designed to cover the needs of a typical earthquake engineering stability analysis; preparation of input data (pre-processing), response computation and stability analysis (post-processing). In order to validate the application over GRID, a simplified model of structure under artificially generated earthquake records has been implemented. To achieve this goal, the proposed scheme exploits the GRID technology and its main advantages (parallel intensive computing, huge storage capacity and collaboration analysis among institutions) through intensive interaction among the GRID elements (Computing Element, Storage Element, LHC File Catalogue, federated database etc.) The dynamical model is described by a set of ordinary differential equations (ODE's) and by a set of parameters. Both elements, along with the integration engine, are encapsulated into Java classes. With this high level design, subsequent improvements/changes of the model can be addressed with little effort. In the procedure, an earthquake record database is prepared and stored (pre-processing) in the GRID Storage Element (SE). The Metadata of these records is also stored in the GRID federated database. This Metadata contains both relevant information about the earthquake (as it is usual in a seismic repository) and also the Logical File Name (LFN) of the record for its later retrieval. Then, from the available set of accelerograms in the SE, the user can specify a range of earthquake parameters to carry out a dynamic analysis. This way, a GRID job is created for each selected accelerogram in the database. At the GRID Computing Element (CE), displacements are then obtained by numerical integration of the ODE's over time. The resulting response for that configuration is stored in the GRID Storage Element (SE) and the maximum structure displacement is computed. Then, the corresponding Metadata containing the response LFN, earthquake magnitude and maximum structure displacement is also stored. Finally, the displacements are post-processed through a statistically-based algorithm from the available Metadata to obtain the probability of collapse of the structure for different earthquake magnitudes. From this study, it is possible to build a vulnerability report for the structure type and seismic data. The proposed methodology can be combined with the on-going initiatives to build a European earthquake record database. In this context, Grid enables collaboration analysis over shared seismic data and results among different institutions.