Chair of Structural Mechanics
TUM Department of Civil, Geo and Environmental Engineering
Technical University of Munich

Master's Thesis

Finite Element Modeling of Building Vibrations Under Induced Seismicity

Motivation

In the near future, geothermal energy is bound to play a critical role in the transition to sustainable energy sources. Earthquakes may be induced by the sub-surface explorations performed at the geothermal power plants [1,2]. In most cases, these vibrations are considered a general nuisance similar to the vibrations resulting from railway track operations. However, given the heightened public concern regarding induced seismicity, it is crucial to identify and analyze the effects of these micro-seismic events resulting due to geothermal operations on the built environment.

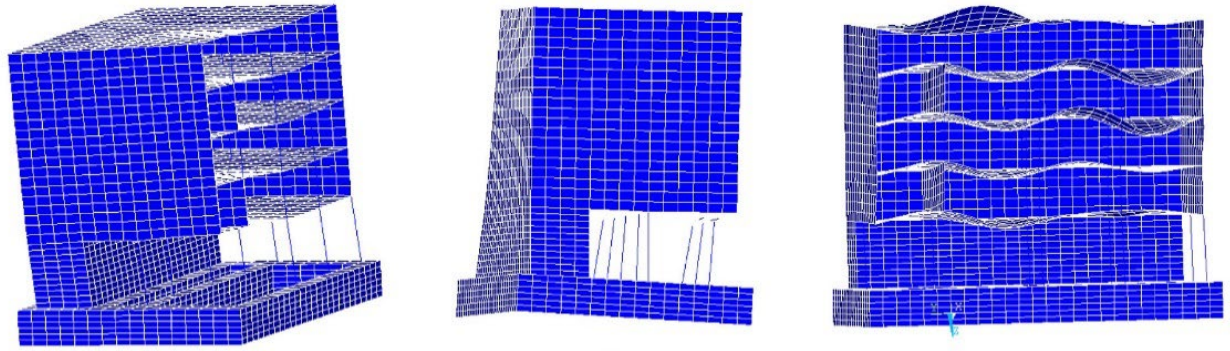

Fig. 1: Example of the various mode shapes of a FE building model

Tasks

In the scope of this thesis, finite-element (FE) building models [3] will be developed based on the building typologies identified for the Munich area. The response analysis of those FE models will be performed under base excitation to obtain the ceiling vibrations. Various stages for the thesis are listed below:

1. Literature review of the FE modeling of buildings
2. Development of linear building models for pre-defined taxonomy classes in ANSYS
3. Parametric analysis of the building response

Literature

1. Grünthal, G. (2014). Induced seismicity related to geothermal projects versus natural tectonic earthquakes and other types of induced seismic events in Central Europe. Geothermics, 52, 22-35.
2. Küperkoch, L., Olbert, K., & Meier, T. (2018). Long-term monitoring of induced seismicity at the Insheim geothermal site, Germany. Bulletin of the Seismological Society of America, 108(6), 3668-3683.
3. Papadopoulos, M., François, S., Degrande, G., & Lombaert, G. (2018). The influence of uncertain local subsoil conditions on the response of buildings to ground vibration. Journal of Sound and Vibration, 418, 200-220.

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