Abstract

It is well known that seismic waves are affected by the geological and topographic nature of the different layers in which they propagate close to the surface. These phenomena called site effects are responsible for modifications of the spatial, spectral, and temporal characteristics of the wave field due to wave combinations between the incident signal and the reflected, refracted, or diffracted waves on the different structural or topographic elements. This will usually result in an amplification of the ground motion acceleration likely to induce failure of structures located on the surface or slope instabilities. As the geometry and the soil conditions can vary over small distances, this spatial variability of the ground motion can be important over small surfaces. During the last years, many research studies have been done on simplified slope geometry to identify the effect of geological, topographic and input signal parameters on the amplification of the amplitude of seismic waves. The purpose of my thesis is to test more realistic slope geometry, and mainly to complete this numerical work by performing a careful comparison between well-constrained modeling and field observations on the experimental site of Byblos in Lebanon. Site investigations will allow acquiring the geological and seismic data necessary for the simulations and to perform a micro zoning on the site. Then, a numerical study, using SFECFEM Code and FLAC 2D/FLAC3D software, will allow comparing results from numerical simulations with instrumentation data in terms of spatial distribution of soil movement as well as consequences in terms of slope stability and building vulnerability. This report describes the site effects, and the work done by some researchers in this domain, then it shows the first field investigations performed in Byblos, Lebanon, to study the geological characteristics of this site. The latter will be then used to build a realistic model for numerical analysis.