Geophysical Research Abstracts
Vol. 21, EGU2019-6891, 2019
EGU General Assembly 2019

Exploring changes in building strength using seismic wave deconvolution

Yu Ting Chou, Chun Fu Liao, and Strong Wen

National Chung Cheng University, Institute of Seismology, Minhsiung, Chiayi, Taiwan (s839255704@gmail.com)

In order to avoid the casualties caused by damaged buildings during strong earthquakes, it's important and essential to understand the seismic design specifications of buildings. The motion of a building depends on the interferometry of building and ground motion, the coupling between building and ground, and the mechanical properties of the building. We applied deconvolution to the motion recorded to separate the building response. Deconvolution interferometry is a powerful and convenient tool which allow us to extract structural parameters (e.g., shear wave velocity, resonance frequency and attenuation parameter) from seismic records. By applying deconvolution to earthquake records, it can provide a complete response of the building and understanding the motion pattern of the structure under strong motion. Therefore, we can check medium's state by tracking resonance frequency, shear wave velocity and the attenuation parameter Q to avoid damage of building in the next mega-earthquake. We deployed a seismograph array in the library of National Chung Cheng University, Taiwan, which recorded earthquakes and few months of ambient noise record. The shear wave velocity from the seismic record was calculated to be 225.26±24.29 m/s. We also used seismic record to calculate the Q value of each floor and found that the Q value for the lower floors (Q=16) was lesser on average than the higher floors (Q=23). We believe that this reflects partial energy of the wave dissipated to the surface during transfer, making the Q value of the lower floors is lesser. On the other hand, we estimated the similar shear wave velocity 289.9±7.6 m/s from ambient noise record for the entire building as well. In advance, we divided the structure into low- and high-floors to calculate the shear wave velocity from the upward and downward propagation. We found that the shear wave velocities of the low and high floors are significantly different but exhibit a stable variation. For the monitoring phase, calculating the velocity variation from ambient noise depends on stacking signal to gain better S/N ratio and more convergent result. Therefore, for ambient noise calculation, we tried different stacking time-lengths and calculated the related shear wave velocities which the results are similar to the analysis in earthquake. From the above results, we concluded that the physical parameters of the building are stable and implied that the structure is in a healthy condition. Finally, we hope these results would be helpful to build a long-term monitoring of building's healthy status and the assessment of seismic hazard.