SSS23-P12 Room:Poster Time:May 1 18:15-19:30

Physics-based decomposition of ground amplification using ground transfer function expansion

GOTO, Hiroyuki[1*]

[1]DPRI, Kyoto University

Amplification of earthquake ground motions at actual deposit sites is an important factor to consider when assessing the risk of an earthquake disaster. In order to identify the amplification properties, several preprocessings such as the Fourier transform are required. I propose a series expansion of the amplification with simple ground transfer functions as a new preprocessing. I define a sequence of transfer functions based on a two-layered structure excluding an internal damping, and a function space spanned by the set of the functions. I mathematically prove that the function space is equal to L2 space. This indicates that all the functions belonging to L2 space, i.e., an arbitrary ground amplification, have a unique series expansion.

In practice, the expansion requires the observed ground amplification. It is directly observable from the spectral ratio of the Fourier spectra at the target site to that at a reference rock site (Goto et al., 2013). When the observations are available, the expansion is applicable even for the site response including a 3D basin effect as the preprocessing, whereas it requires a more precise investigation of what the extracted components physically means for the general cases.

I apply the series expansion to the physics-based decomposition of the amplification. The results indicate that the contribution from the given bases can be represented by the absolute value of their coefficients. The contribution may enable direct quantification of the similarity of models. This property potentially has wide applications, e.g., spatial interpolation of the amplifications from the sites where they are reliably determined, stochastic modeling of the amplification as a mixed state of the fundamental simple states, etc. The detailed application is currently under way.

References

Goto, H.: Series expansion of complex ground amplifications with a sequence of simple transfer functions, Earth. Engng. Struct. Dyn., submitted.

Goto, H., Kawamura, Y., Sawada, S. and Akazawa, T.: Direct estimation of near-surface damping based on normalized energy density, Geophys. J. Int., 194(1), 488-498, 2013.

Keywords: Ground amplification, Function expansion