Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS26-P22 Room:Convention Hall Time:May 20 17:15-18:30

Dynamic Analysis of Earthquake Amplification Effect of Slopes in Different Topographic and Geological Conditions

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Slope failure is always triggered by earthquake, and brings damage to society. In dynamic analysis of slope stability considering the seismic loading, it is important to understand the amplification effect of slope due to topographic and geological structure. However, because the effect processes due to topographic and geological structure are too complicated, the amplification effects are not clear. In this study, an attempt using Abaqus, a FEM software, to clarify the amplification effects is conducted.

At first, infinite element is adopted in the boundary condition. Result of a example slope model is verified by a published centrifuge test result. Analysis has been conducted on the amplification effect for a homogeneous slope due to different height, angle, seismic wave, and dip angle of alternating layers of tuff and shale. Finally, the amplification effects of south-north direction slope and east-west direction slope around the Shimane nuclear power plant (Shimane-NCPP) have also been analyzed.

In this study, amplification factor is defined as the ratio of output peak acceleration to the input acceleration. As the result, (1) at slope top and middle, amplification factor becomes smaller when the slope height becoming larger; (2) amplification factor of slope top becomes relatively bigger when the slope angle becoming larger, however amplification factor of slope foot becomes relatively smaller; (3) amplification tendency does not show obvious difference for seismic wave and dip angle of strata layer; (4) south-north direction slope around the Shimane-NCPP shows high amplification factor near slope top, while east-west direction slope around the Shimane-NCPP shows high amplification factor near slope foot.

Keywords: Abaqus software, amplification effect, infinite element, eartquake, slope failure