INFLUENCE OF UNDERGROUND CAVITY ON THE SEISMIC RESPONSE OF U-SHAPED CANYON USING BEM

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With regard to development of urban transportation and population growth, using of underground structures and cavities such as subway and tunnels are necessary. Hence, same structures such as bridges and dams are normally located in the canyon shaped topographic features (Sanchez-sesma, 1987 ; Gazetas and Dakoulas 1992; Aviles and Perez-Rocha 1998), it is essential to study the seismic interaction between them. In this study an attempt is made to study the effect of U-Shaped canyon geometry on strong ground motion. Response analysis was made for the different sizes U-shaped canyons in the presence of different vertical position of underground cavities. Figure1 shows the geometry and variable parameters of the U-Shaped canyon and underground cavity subjected to vertically propagating incident SV wave. In this figure, d, a, H, H_0 *and* L are the buried depth of the cavity relative to the roof of the cavity, the cavity radius, the depth of the center of U-shaped canyon, the height of the wall of U-Shaped canyon and the half-width of the canyon, respectively. The result showed that the response is strongly influenced by size of U-Shaped canyon. In order to take these factors into account, U-Shaped canyon with different h/L, d/L, a/L, H_0/H and with dimensionless period interval of 0.5 to 8.33, were assumed (Alielahi, 2012).

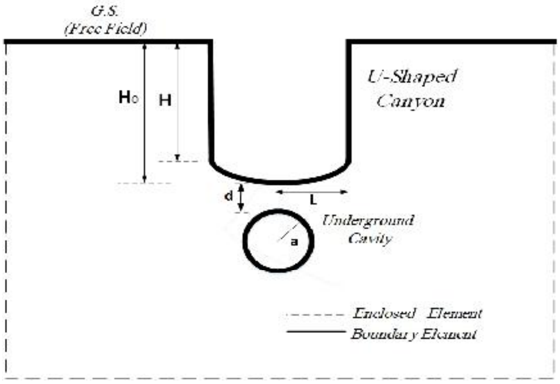

Figure 1. Schematic Geometry of U-Shaped Canyon with Underground Cavity

Table 1 summarizes the variable parameters in these parametric studies.

Table1.Variable parameters for parametric studies

Dimensionless Parameters	Variable Parameters
WR=a/L	0.25,0.5,1
DR=d/L	0.25,0.5,1.0, 1.5,2.0
SR=H/L	0.3,0.5,1
HR=H_0/H	1.2

The main aim of this paper is using of an efficient computer program called SAMBE (**S**eismic **A**nalysis **-** of **M**ultiple **B**oundary **E**lement) was developed by Alielahi (2012) and Alielahi et al. (2013) based on time-domain boundary element method. In this paper, the medium is assumed to have a linear elastic constitutive behavior subjected to vertically propagating incident SV waves. The type of vertically propagating waves was assumed as Ricker wavelets. The equation of Ricker wavelet is shown as follows:

$$f(t)=A_{max}[1-2.(\pi.f_p.(t-t_0))^2]\, e^{-(\pi.fp.(t-t_0))^2} \qquad (1)$$

In which f_p, t_0, t and *Amax* demonstrate the predominant frequency, the appropriate time shift parameter, the total time and the maximum amplitude of the time-history, respectively. In case of SV waves, *f (t)* designates the horizontal component of the incident motion while the vertical component is zero. Figure 2 demonstrates general perspectives of the scattering and diffraction of waves in 2D U-Shaped canyon (DR=0.25 & SR=0.5) with an embedded cavity subjected to an incident SV wave.

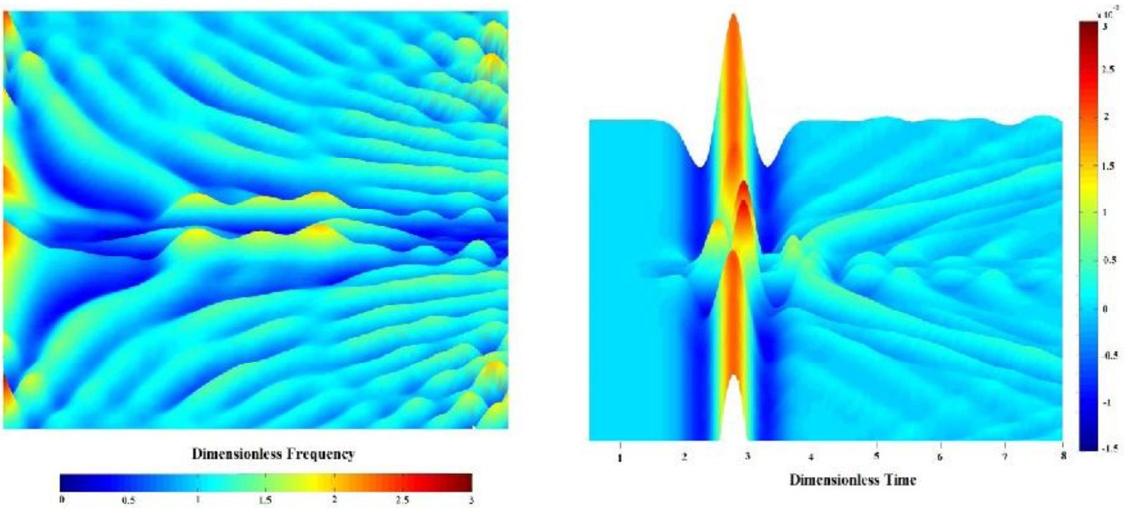

Figure 2. Amplification pattern of 2D U-Shaped canyon with circular cavity subjected to SV wave

The result showed that the buried depth of the cavity relative to the roof of the cavity plays a major role in amplification pattern.

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