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PREDICTION OF GROUND MOTIONS AT ASHIGARA VALLEY USING THE EXTENDED QUASI-THREE-DIMENSIONAL GROUND MODEL

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INTRODUCTION

As a practical model which evaluates ground motions of irregularly bounded surface ground during earthquakes, the quasi-three-dimensional ground model was proposed (Tamura and Suzuki, 1987). It was extended to the model which can take fundamental through arbitrary n-th mode of shear vibrations into consideration (Suzuki and Unami, 1991) and is capable of conducting non-linear analysis adopting the equivalent linear method (Suzuki 1991). This paper provides the prediction results of the earthquake ground motions of Ashigara Valley sites using computer code "EXQ3D" which was coded by the author for the extended model.

MODELING

The modeling procedure used is a simplified hybred model of two-dimensional finite elements and mass-spring-damper systems. As illustrated in Fig.1, soil masses are connected each other by a finite plate element. The model is two-dimensional one but it can deal with three-dimensionasl soil profiles and boundary conditions of a surface ground. Both the time for computation and the effort for modeling are much less than those by 3-D finite element procedure. The area modeled is the region of 3.0 km X 1.5 km along the valley. A linear analysis is carried out for a weak event, whereas a non-linear analysis is applied for a strong event. Since the surface of the layer named as OS-2 is regarded as the rigid base in modeling, the response at KD2 is correspondent with that of KR1 except for the existence of phase difference due to the travelling time from KR1 through KD2. The input ground motions are applied with the consideration of wave propagation from a epicenter with the velocity of 1500 m/sec.

COMPUTED RESULTS AND DISCUSSION

Peak accelerations, velocities and displacements at KS1 and KS2 computed by "EXQ3D" are summarized in Table 1. Comparing the computed peak values with observed ones at KS1 for a small event, computed responses in EW direction are much smaller than observed ones and the analysis does not necessarily gives a good simulation. For a strong event, however, the computed responses at both KS1 and KS2 brought about reasonable ground responses which represent the predominant vibrations originated from the geological condition of the valley; the ground motions in EW direction, which is the direction of major axis of predomonant vibrations, are highly amplified.

CONCLUDING REMARKS

"EXQ3D" was applied for the prediction of earthquake ground motions at Ashigara Valley prediction sites. The predominant vibrations originated from the geological structure of the blind sites were obtained through the analysis for a strong event. It was confirmed that the proposed method is capable of computing effectively the earthquake ground motions of irregularly bounded 3-D surface ground.

Table 1 Computed Peak Accelerations, Velocities and Displacements at KS1 and KS2

Event	Weak Event				Strong Event			
Site	KS1		KS2		KS1		KS2	
Direction	NS	EW	NS	EW	NS	EW	NS	EW
Acc. (gal)	9.70	5.82	10.37	6.75	296.06	303.76	350.08	233.87
Vel. (kine)	0.26	0.16	0.27	0.16	13.17	12.61	17.15	19.34
Disp. (cm)	0.0078	0.0070	0.0092	0.0087	1.066	0.949	1.898	1.887

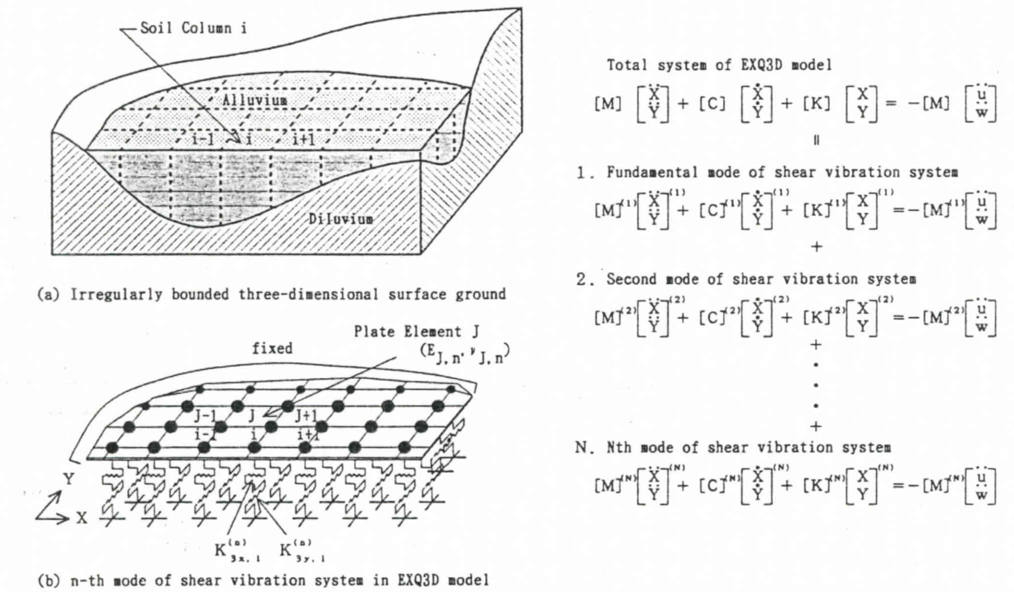

Fig.1 A Schematic Diagram to Represent the Extended Quasi-three-dimensional Ground Model

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