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PREDICTION OF STRONG ACCELERATION MOTIONS USING EMPIRICAL GREEN'S FUNCTION

by

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Abstract

The scaling law of the source spectra was examined for the strong motion records of the sequence of 1983 Japan-Sea earthquake. The spectral shapes for events smaller than magnitude 6.1 give roughly a fit to the ω^{-2} model. However, the spectra of larger earthquakes (M=7.1 and M=7.7) have much larger high-frequency components than those predicted from the ω^{-2} model. The specific barrier model is a useful model to explain rich high-frequency motions. The synthetic method of strong ground motions is studied to match the spectral scaling relation using empirical Green's function technique. In the case that both large and small earthquakes have spectral characteristics predicted from the ω^{-2} model, the summation procedure for synthesis is made to match the moment and the stress drop of the event to be synthesized. Finally a more general method is attempt to synthesize large earthquake motions which have spectral characteristics predicted from the specific barrier model.

INTRODUCTION

We need to discuss the following two problems to predict strong acceleration motions for large earthquakes using empirical Green's function. The first problem is how the source characteristics change with the seismic moment. The scaling law of the seismic spectra is examined by calculating the spectral ratios between the pairs of earthquakes with nearly the same epicenter but different size to avoid the propagation characteristics from source to station. We consider the ω^{-2} model as a reference model to compare the observed to the theoretical, giving moment and fault size. Next the spectra, not explained by the ω^{-2} model, are compared to the specific barrier model, assuming additive parameters, crack size and number of cracks. The second problem is how the strong ground motions for large earthquakes can be synthesized by summing the ground motion records from small earthquakes to satisfy the scaling law of the source spectra.

We examine the above problems by using the strong ground motion records of the sequence of 1983 Japan-Sea earthquake (Akita-Oki). The data set analyzed here range in magnitude from 7.7 to 3.8 determined by JMA (Japan Meteorological Agency) scale. Finally we attempt to synthesize the strong acceleration motions for the mainshock(M=7.7) and the second largest aftershocks(M=6.1) using the smaller earthquake records, respectively.

SYNTHESIS OF STRONG MOTIONS

We consider a rectangular fault (length L,width W) for a large earthquake to be simulated as shown in Fig.1. The fault plane is divided into l × m element. The element size is taken to match the fault size of a small earthquake used as empirical

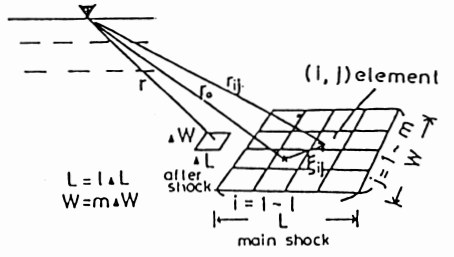

Fig.1. Schematic source model for synthesis.

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