

ESTIMATION OF STRONG GROUND MOTION FOR 2012 AHAR-VARZAGHAN EARTHQUAKE, USING EMPIRICAL GREEN FUNCTION

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On August 11, 2012, 12:23:16 GMT, earthquake with a magnitude of 6.5 occurred in the vicinity of Ahar and Varzaghan in East Azerbaijan province, Northwest Iran. In this paper, the method of Empirical Green Function is applied to the waveforms of first earthquake of the August 11, 2012 Ahar-Varzaghan to estimate the source parameters. By comparing the Fourier spectrum, velocity and displacement of observed and simulated waveforms, it can be seen that the results are in good agreements at frequency of 12, 2 to 25 Hz. Maximum velocity, displacement and duration were calculated at three stations Harris, Kaleybar and Khajeh. The rupture initiated at depth of 8 km. The duration of rupture was 11.5 s. The strike, dip and rake of causative fault are determined as 263, 81 and -180 degrees, respectively.

SIMULATION OF STRONG GROUND MOTION PARAMETERS AND ITS RESULTS

In order to estimate the source parameters of destructive earthquake in the August 11 earthquake of Ahar-Varzaghan, this paper uses the SeismoSignal software for EGF to simulate the strong ground motion. This technique permits estimation of source parameters (seismic moment, corner frequency, rise time, source duration) and rupture characteristics of the earthquake (Irikura, 1991). Empirical green function method suggested by Hartzell is one of the popular and widely used methods in simulating strong ground motion (Raghu, 2008). According to the definitions of the functions associated with this program, a number of earthquake and fault characteristics are defined as input parameters. In this paper, by using the Fourier spectrum, f_c , M_0 , $\Delta\delta$ and M_w are calculated for all stations with a suitable signal-to-noise ratio and the results are shown in Table 1. According to the results, the appropriate depth range of the earthquake is between 8 to 15 kilometers.

Table 1. Calculation of some parameters of earthquake related to Ahar-Varzaghan earthquake.

Station	Record Number	Longitude	Latitude	Distance from Epicenter	f_c	M_0	$\Delta\delta$	M_w
Khajeh	5547	46.589	38.154	17	0.45	$6.75 \cdot 10^{18}$	80	6.5
Kaleybar	5545	47.039	38.870	21	2.3	$6.75 \cdot 10^{18}$	70	6.5
Harris	5540	47.119	38.247	28	1.56	$6.75 \cdot 10^{18}$	60	6.5

Using the function of Wells and Coppersmith (1994), the length of fault for the earthquake of Ahar-Varzaghan is 18 km and the fault width is about 10 km. The epicenter coordinates were calculated to be 46.80 E and 38.49 N and its focal depth was obtained about 8 km. The results are consistent with the report of Geophysics Institute of Tehran University. The starting point of the rupture, in this study, indicates the propagation of the rupture from northeast to southeast. The comparison of observable and simulated strong motion parameters are shown in Table 2.



Table 2. Comparison of observed and simulated strong motion parameters.

Station	Parameter	Observed			Simulated		
		L	T	V	L	T	V
Khajeh	PGV (cm/s)	9.12	21.55	4.54	12.97	25.01	6.06
	PGD (cm)	0.81	2.29	0.04	1.47	2.88	0.67
	Duration (s)	17.97	16.70	14.52	16.19	16.19	17.49
Harris	PGV (cm/s)	3.13	3.78	2.11	5.14	5.63	3.44
	PGD (cm)	0.15	0.17	0.04	0.53	0.80	0.04
	Duration (s)	10.40	12.30	12.19	14.76	16.32	16.50
Kaleybar	PGV (cm/s)	2.16	4.97	0.83	1.14	4.29	2.15
	PGD (cm)	0.10	0.46	0.12	0.14	0.54	0.18
	Duration (s)	16.28	17.23	15.09	14.76	19.04	22.54

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