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Relation among PGA, PGV, Response Spectrum and Fourier Spectrum

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X	Y	f(Hz)	CC r2	a1	b1	a2	b2	AA	BB	1/AA	-BB/AA
Pseude Velocity Response Specpectrum h=5%	Acceleration Fourier Spectrum	1	0.9245	1.1064	0.1297	0.8356	-0.1689	1.1507	0.1652	0.8691	-0.1436
		2	0.9313	1.0688	0.2041	0.8714	-0.2170	1.1074	0.2262	0.9030	-0.2042
		3	0.9273	1.0376	0.2272	0.8936	-0.2384	1.0776	0.2466	0.9280	-0.2289
		4	0.9242	1.0160	0.2469	0.9096	-0.2588	1.0569	0.2653	0.9462	-0.2511
		5	0.9133	1.0049	0.2649	0.9088	-0.2806	1.0516	0.2863	0.9510	-0.2723
		6	0.8988	0.9956	0.2708	0.9028	-0.2939	1.0501	0.2974	0.9523	-0.2832
		7	0.8852	0.9914	0.2737	0.8929	-0.3054	1.0538	0.3068	0.9490	-0.2912
		8	0.8634	0.9941	0.2856	0.8685	-0.3273	1.0699	0.3296	0.9347	-0.3081
		9	0.8463	1.0029	0.2954	0.8439	-0.3454	1.0902	0.3500	0.9173	-0.3210
		10	0.8321	1.0017	0.2918	0.8307	-0.3555	1.0981	0.3567	0.9106	-0.3249
PGA	Acceleration Fourier Spectrum	1	0.1485	0.6539	-1.2971	0.2271	1.0119	1.6967	-2.1755	0.5894	1.2821
		2	0.2234	0.7043	-0.9641	0.3172	0.9600	1.4901	-1.6261	0.6711	1.0912
		3	0.3368	0.7544	-0.8622	0.4464	0.9436	1.3000	-1.3218	0.7692	1.0168
		4	0.4513	0.8051	-0.8288	0.5605	0.9267	1.1986	-1.1602	0.8343	0.9680
		5	0.5422	0.8340	-0.8330	0.6502	0.9272	1.1326	-1.0845	0.8830	0.9576
		6	0.5972	0.8468	-0.8596	0.7053	0.9455	1.0957	-1.0693	0.9126	0.9759
		7	0.6353	0.8733	-0.9112	0.7274	0.9700	1.0957	-1.0985	0.9126	1.0026
		8	**0.6563**	0.9015	-0.9622	0.7280	0.9900	1.1128	-1.1401	0.8986	1.0246
		9	0.6414	0.9172	-1.0136	0.6993	1.0108	1.1453	-1.2057	0.8732	1.0527
		10	0.6256	0.9172	-1.0656	0.6821	1.0422	1.1596	-1.2698	0.8623	1.0950
PGV	Acceleration Fourier Spectrum	1	0.3891	1.0119	-0.2478	0.3846	-0.2056	1.6221	0.0528	0.6165	-0.0325
		2	0.4351	0.9396	0.0920	0.4630	-0.3208	1.4246	0.3308	0.7020	-0.2322
		3	**0.4749**	0.8564	0.1951	0.5545	-0.3668	1.2428	0.3854	0.8046	-0.3101
		4	0.4704	0.7859	0.2366	0.5986	-0.4024	1.1459	0.4139	0.8727	-0.3612
		5	0.4391	0.7175	0.2229	0.6120	-0.4127	1.0827	0.4028	0.9236	-0.3720
		6	0.3836	0.6488	0.1733	0.5913	-0.4061	1.0475	0.3697	0.9546	-0.3529
		7	0.3388	0.6098	0.1248	0.5557	-0.3950	1.0475	0.3404	0.9546	-0.3250
		8	0.2904	0.5733	0.0796	0.5065	-0.3898	1.0638	0.3212	0.9400	-0.3020
		9	0.2461	0.5431	0.0266	0.4531	-0.3834	1.0949	0.2983	0.9133	-0.2725
		10	0.2165	0.5158	-0.0389	0.4197	-0.3696	1.1086	0.2531	0.9020	-0.2283

For engineering purpose, PGA, PGV and response spectrum are important indicators to evaluate strength of ground motion. Though, theoretical calculations can not provide these indicators directly because source spectrum amplitudes are generally given as Fourier spectrum. Therefore, in this study, we examined the relation among Fourier spectrum, PGA, PGV and response spectrum.
We used 111,083 records of K-NET, and calculated Fourier spectrum FS(f) and pseude-velocity response spectrum RS(f) at h=5%. To obtain Fourier spectrum FS(f) at frequency f, we took the

geometric mean in ranges from f-0.5 Hz to f+0.5 Hz.
We obtained the coefficient of regression by using following equations,
log[FS(f))=a1(f)*log[RS(f)]+b1(f),
log[RS(f)]=a2(f)*log[FS(f)]+b2(f),
log[FS(f)]=AA(f)*log[RS(f)]+BB(f)
Here, AA and BB are geometrical mean of a1,a2 and b1,b2 (see Utsu, 1984).
Results of the regression are shown in the table : the coefficients for PGA and PGV also shown in the table.
The correlation coefficients CC between Fourier spectrum and pseude-velocity response spectrum are high and the response spectrum level at h=5% tend to be lower than the Fourier spectrum at small amplitude level at low frequency. Response spectra can be had amplitude in the case of no component of seismic ground motion. The correlation coefficients of PGA and PGV are lower and different with frequencies.
Predictions of seismic ground motion by using the relation between Fourier spectrum and response spectrum show good agreement with observations.
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Keywords: PGA, PGV, Response Spectrum, Fourier Spectrum