

FREQUENCY CONTENTS OF STRONG MOTIONS FROM ROMANIAN SUBCRUSTAL EARTHQUAKES

Dan LUNGU

Professor, Technical University of Civil Engineering, Bucharest, Romania
lungud@utcb.ro

Florin PAVEL

Assistant Professor, Technical University of Civil Engineering, Bucharest, Romania
florin.pavel@utcb.ro

Radu VACAREANU

Professor, Technical University of Civil Engineering, Bucharest, Romania
radu.vacareanu@utcb.ro

Keywords: Frequency Content Indicators, Response Spectra, Dynamic Amplification Factor

The Vrancea seismic source, located at the Carpathian Mountains bending, is a source of subcrustal seismic activity (depths from 60 to 170 km), which affects more than 2/3 of the territory of Romania and an important part of the territories of Republic of Moldova, Bulgaria and Ukraine.

Ground motions records from the Vrancea earthquakes of March 4, 1977 ($M_w = 7.5$, $h = 109$ km), August 30, 1986 ($M_w = 7.2$, $h = 131$ km) and May 30, 1990 ($M_w = 6.9$, $h = 91$ km) show various frequency contents, from wide and/or intermediate frequency bandwidth ground motions (in hard and/or medium soil conditions) to narrow frequency band ground motions with long predominant periods ($T_p = 1.4 \div 1.6$ s) in central Bucharest. The random frequency content of the recorded strong ground motions clearly depends on magnitude and local soil conditions, as well as on epicentral distance.

The assessment of the frequency contents of Romanian strong ground motions using the power spectral density and its related indicators: the dimensionless frequency bandwidth indicators α and q , as well as the fractile frequencies f_{10} , f_{50} and f_{90} is presented in the paper of Lungu et al. (1992).

Amongst the important deterministic indicators of the frequency contents of ground motion records are the control periods of structural response spectra originally introduced by Newmark and Hall (1982). These control periods are very significant concepts for building codes provisions. The evolution of the definition of the control periods during the years 1978 – 2010 is shown in the paper of Pavel and Lungu (2012) and is applied to various worldwide strong ground motions. Other deterministic indicators of the frequency contents are the mean period T_M defined in (Rathje et al., 1998) and the period at which the maximum spectral acceleration is encountered, also discussed in this study.

The study focuses mainly on: (i) the evaluation of the frequency content of strong ground motions from the largest Vrancea earthquakes which occurred in the last 30 years in Romania with emphasis on predominant period concept and (ii) the impact of the results on the most recent version of the Romanian seismic design code (P100-1/2013). The study emphasizes the dependence of the frequency contents of the strong ground motions recorded in soft soil conditions on the earthquake magnitude. Moreover, the values of the dynamic amplification factors (defined as the maximum spectral acceleration divided by the peak ground acceleration) for some of the most representative narrow frequency band ground motions in the world are discussed as a function of the number of cycles.

REFERENCES

- Lungu D, Demetriu S and Cornea T (1992) Frequency bandwidth of Vrancea earthquakes and the 1991 edition of seismic code in Romania, *Proceedings of the 10th World Conference on Earthquake Engineering*, Madrid, Spain, 10: 5633-5638
- Newmark N and Hall WJ (1982) *Earthquake spectra and design*, Earthquake Engineering Research Institute, Berkeley, California

P100-1/2013 (2013) Code for seismic design – Part I – Design prescriptions for buildings, Ministry of Regional Development and Public Administration, Bucharest, Romania

Pavel F and Lungu D (2012) Frequency content indicators of strong ground motions, *Proceedings of the 15th World Conference on Earthquake Engineering*, Lisbon, Portugal, Paper no. 2372

Rathje E, Abrahamson N and Bray J (1998) Simplified frequency content estimates of earthquake ground motions, *Journal of Geotechnical and Geoenvironmental Engineering*, 124(2): 150-159

