Comparison of fully non-stationary artificial accelerograms generation methods in non-linear dynamic analyses

F. Genovese[1,2,*)], **G. Muscolino**[2)], **and A. Palmeri** [1)]

[1)] School of Civil and Building Engineering, Loughborough University, Loughborough, LE113TU, United Kingdom,
F.Genovese@Lboro.ac.uk, A.Palmeri@Lboro.ac.uk

[2)]Department of Engineering, University of Messina, Messina, 98166, Italy
fedgenovese@unime.it, gmuscolino@unime.it

Keywords: *Artificial accelerogram; Ground motion record; Inelastic response spectrum; Non-stationary stochastic process; Signal processing; Wavelets transform; Spectrum-compatible accelerogram.*

Abstract

Non-linear dynamic analyses are a powerful tool to assess the performance of earthquake-resistant structural and geotechnical systems.

Inevitably, the validity of the predicted seismic responses depends on the fidelity of the computational model to the true behaviour of the assets being analysed and the representativeness of time histories of ground acceleration in relation to the actual seismic hazard for the site under consideration.

The generation of artificial time histories is generally allowed by international seismic codes and represents a valid alternative to the use of real accelerograms, provided that the key features in the expected seismic input are preserved in the generated signals. As a consequence, different stochastic generation methods of fully non-stationary, spectrum-compatible accelerograms have been proposed in the technical literature.

The effects of two alternative randomisation strategies are compared in this paper, based respectively on the use of i) circular wavelet transform (Newland, 1994) and ii) evolutionary piecewise power spectral density functions (Muscolino et al. 2021).

The case of a simple nonlinear structural system with an elastoplastic behaviour is addressed, as representative of a broad range of structural and geotechnical systems that experience yielding and plastic deformations under relatively intense seismic events.

References

Muscolino, G., F. Genovese, G. Biondi and E. Cascone. Generation of Fully Non-Stationary Random Processes Consistent with Target Seismic Accelerograms. *Soil Dynamics and Earthquake Engineering*, 141(106467):1-14, 2021.

Newland D. Harmonic and musical wavelet. *Proceedings Royal Society A*, Vol. 444, pp.605-620, 1994.