Explicit sensitivities of the stochastic response of structural systems under spectrum compatible fully non-stationary seismic excitations

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Abstract

The sensitivity analysis is a suitable vehicle to evaluate the variation of structural responses under the influence of changes of structural parameters. It has been recently recognized that ground motion accelerations change both in their amplitude and frequency content and can be classified as non-stationary processes. It follows that the sensitivity of the response evolutionary power spectral density (*EPSD*) of structures subjected to non-stationary stochastic processes is an essential information and, consequently, it plays a fundamental role in structural design (Arora and Haug 1979).

In this study handy expressions for the evaluation of sensitivities of stochastic response characteristics of structural systems with damping devices subjected to seismic excitations, modelled as fully non-stationary Gaussian stochastic spectrum compatible processes, are evaluated. Since the structural systems with damping devices are non-classically damped, first, according to the formulation recently proposed by Alderucci and Muscolino (2018), the time-frequency varying response (*TFR*) function vector for non-classically damped systems is evaluated in explicit form. Then, closed form solutions for the first-order derivatives of the *TFR*, as well as of the one-sided *EPSD* of the structural response, with respect to device parameters are evaluated.

References

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