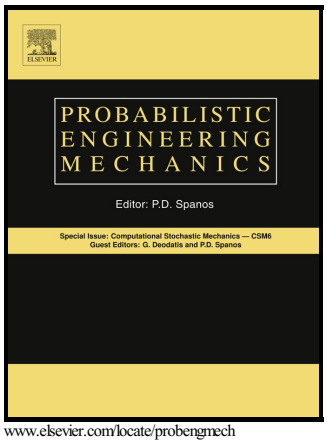
Structural response variability under spatially dependent uncertainty: stochastic versus interval model

Alba Sofi



www.elsevier.com/locate/probengmech

PII: S0266-8920(15)30028-X
DOI: http://dx.doi.org/10.1016/j.probengmech.2015.09.001
Reference: PREM2846

To appear in: *Probabilistic Engineering Mechanics*

Received date: 15 November 2014
Revised date: 18 July 2015
Accepted date: 4 September 2015

Cite this article as: Alba Sofi, Structural response variability under spatially dependent uncertainty: stochastic versus interval model, *Probabilistic Engineering Mechanics,* http://dx.doi.org/10.1016/j.probengmech.2015.09.001

STRUCTURAL RESPONSE VARIABILITY UNDER SPATIALLY DEPENDENT UNCERTAINTY: STOCHASTIC VERSUS INTERVAL MODEL

Alba Sofi*

Department of Civil, Energy, Environmental and Materials Engineering, University "Mediterranea" of Reggio Calabria, Via Graziella, Località Feo di Vito, 89124 Reggio Calabria, Italy.

E-mail: alba.sofi@unirc.it

Abstract

This paper deals with structural response variability under spatially varying uncertainties represented using both probabilistic and non-probabilistic models. Attention is focused on Euler-Bernoulli beams with uncertain flexibility subjected to deterministic static loads. Within the probabilistic framework, the uncertain flexibility is modeled as a random field and the well-established concept of variability response function is adopted to derive spectral- and probability-distribution-free upper bounds on the response variability. Within the non-probabilistic context, the uncertain property is represented resorting to a recently proposed interval field model able to quantify the dependency between adjacent values of an interval uncertainty that cannot differ as much as values that are further apart. For statically determinate beams, the interval displacement field and the associated bounds are evaluated analytically by using a Green's function formulation. Conversely, for statically indeterminate beams, approximate explicit expressions of the bounds of the interval response are derived by applying a finite difference based procedure.

Numerical results present consistent comparisons between response variability under random and interval uncertainty for both statically determinate and indeterminate beams.

Keywords: Uncertain material/geometric properties, spatial variability, random field, interval field, variability response function, lower bound and upper bound, interval rational series expansion.

*Corresponding author: e-mail alba.sofi@unirc.it; Tel. +39 0965 1692225