Stochastic finite elements: a B-spline approach

Diego L. Allaix[1], *Vincenzo I. Carbone*[1], *Giuseppe Mancini*[1]

[1]Department of Structural, Geotechnical and Building Engineering, Politecnico di Torino
Corso Duca degli Abruzzi 24, 10129 Torino, Italy

ABSTRACT

The paper presents a framework for the uncertainty analysis of structures characterized by random properties or subject to random loads. These uncertainties are modeled by random variables and random fields. The Karhunen–Loève expansion is used to perform the random field discretization, which allows to represent the uncertainties by means of a random finite dimensional vector.
The structural response is expressed by a Polynomial Chaos Expansion in terms of the input random vector. A non-intrusive approach is adopted for the purpose. The novelty of the paper consists in the use of B-spline basis functions for the approximation of the structural response. B-spline functions are widely used in computer aided engineering and computer aided manufacturing, because they are flexible and accurate tools for the representation of surfaces. As a result, the proposed framework leads to a dramatic reduction of the computational effort of the uncertainty analysis.

Keywords: Stochastic FEM, random fields, B-spline basis functions.