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1 Stochastic static analysis of Euler-Bernoulli type functionally graded structures

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6 Abstract

7 In this study, the uncertain static analysis of Euler-Bernoulli type functionally graded
8 structures with probabilistic parameters is investigated. An effective, yet efficient,
9 computational method is proposed within the framework of the finite element analysis (FEA).
10 Various uncertain systematic parameters, which are including the material properties,
11 dimensions of structural elements, as well as applied forces, can be simultaneously
12 incorporated within the unified analysis framework. By meticulously combining the matrix
13 perturbation theory with Taylor's series expansion, both first and second order statistical
14 characteristics (i.e., mean and variances) of the concerned structural responses can be
15 robustly estimated for practically motivated functionally graded structures. In order to
16 illustrate the applicability, accuracy, as well as efficiency of the proposed computational
17 approach, three distinctive functionally graded engineering structures are thoroughly
18 investigated by comparing the performance of the proposed approach with the simulation
19 based reference method. Furthermore, complementary parametric investigations are also
20 conducted to explore the sensitivity of the Euler-Bernoulli type functionally graded structures
21 against various degrees of uncertainty of each considered uncertain system parameter.

22 Keywords:

23 A. Functional composites; B. Defects; C. Computational mechanics; C. Finite element
24 analysis (FEA); Uncertainty analysis.

25

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