11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

THE EFFECT OF RANDOM MATERIAL PROPERTIES ON THE PROBABILISTIC BEHAVIOR OF FUNCTIONALLY GRADED PLATES

Ta Duy Hien[1], Hyuk Chun Noh[1]

[1] Department of Civil and Environmental Engineering, Sejong University, 98 Gunja, Gwangjin, 143-747, Republic of Korea, tdhiengt@gmail.com, cpebach@sejong.ac.kr

Key Words: *Functionally Graded Material Plate, Uncertainty, Spectral Representation.*

In this study, the stochastic response of a functionally graded (FG) plates with uncertain material properties is addressed. In the FG materials, the material properties, such as elastic modulus and mass density, vary along the thickness direction following exponential law. Since this feature defines the essence of FG materials, we assume that the through thickness variation does not have any randomness. This means that we only assume the spatial random variation of material constants in the plane-direction of the FG plates.

In case of elastic modulus of FG plates, the deterministic properties at top and bottom are different from each other, defining the boundary values of the property at both surfaces[1]. This circumstance necessitates the need to have two independent random variables in order to deal with material randomness in analyses FG material plane structures.

In order to investigate into the response variability of FG plates, the brute force Monte Carlo simulation is employed. Random fields, which represent the spatial fluctuation of material properties, are numerically generated by using spectral representation method[2]. In order to investigate the effect of correlation between material properties at top and bottom surfaces, we consider whole range of correlation: from negative perfect to positive perfect correlation and no correlation as well.

The probabilistic response of FG plates is shown to be different from the isotropic material plates and composite plate as well[3]. Furthermore, the response is obseraved to be affected by the correlation between the randomness at the top and bottom surfaces.

Acknwledgement

This work was supported by the Human Resources Development program(No. 20124030200050) of the Korea Institute of Energy Technology Evaluation and Planning(KETEP) grant funded by the Korea government Ministry of Trade, Industry and Energy.

REFERENCES

[1] T. D. Hien and H. C. Noh, Analytical solution for the transient response of functionally graded rectangular plates subjected to moving loads. *APCOM & ISCM*, December 11-14th, Singapore, 2013.

[2] M. Shinozuka and G. Deodatis. Simulation of multi-dimensional Gaussian stochastic fields by spectral representation method. Appl. Mech Rev. Vol **49**, No. 1, 1996.
[3] H. C. Noh and T. Park. Response variability of laminate composite plates due to spatially random material parameter. *Computer Methods in Applied Mechanics and Engineering*, Vol. **200**, Issues 29-32, pp.2397-2406, 2011.