A random variable transformation for evaluating the uncertainty propagation in mechanical systems

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Abstract

The behavior of any mechanical system is affected by a level of uncertainties of the quantities modeling the fundamental governing equations. In many cases the level of uncertainties is so low that they are neglected, making the system equations deterministic. In other cases neglecting the random character of some quantities (the external loads and/or the mechanical material) and assuming the system response as deterministic can conduct unacceptable imprecisions. In these cases, the application of a stochastic analysis becomes necessary. Among the numerous methods of stochastic developed in the last years by various authors, here we want to focus on an approach introduced some years ago by the authors, which is called the Probability Transformation Method (PTM), due to the good level of efficiency and accuracy characterizing it [**?**]. Essentially, once the input and the output quantities characterizing the governing equation of the system are defined, the approach consists in applying a random variable transformation rule that gives directly the Joint Probability Density Function (JP|DF) of the output, once the JPDF is fixed. The only condition imposed by the PTM is that the input-output law must be invertible, eventually even in numerical form. In this work, the propagation of uncertainty is analyzed for both the cases of uncertainties are only on the external actions and when they affect the mechanical and geometrical quantities of the system.

References

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