Solving a homogeneous linear second-order differential equation with randomized complex coefficients

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Abstract

Differential equations and complex analysis have a significant role in modern engineering and physics and they have multiple applications in quantum mechanics, fluid mechanics, nuclear engineering and complex geometry. Given its extensive interest in the deterministic literature, in this work, a particular linear second-order random differential equation with complex coefficients is considered.

Our objective is to determine an exact expression for the first probability density function of the solution stochastic process considering that the input parameters, constant coefficients and initial conditions, are real random variables. To complete the probabilistic analysis, the first probability density functions of the real and complex contributions of the solution stochastic process are also calculated. To compute the densities, the random variable transformation method is applied under general hypothesis.

Finally, to show the capability of the theoretical results in a real physic problem, we analyse the solution of a randomized simple harmonic oscillator, defined on the complex domain, and compare our results with those obtained by using Monte Carlo simulations.

References

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