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Efficient Bounds for the Monte Carlo – Neumann Solution of Stochastic Thermo-Elasticity Problems

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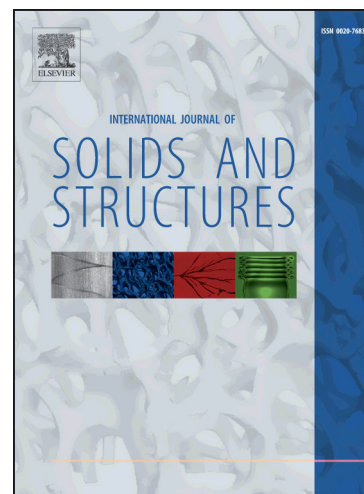
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3 **Solution of Stochastic Thermo-Elasticity Problems**

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14 **Abstract:** The numerical solution of stochastic thermo-elasticity problems can be computationally
15 demanding. In this article, a well-known property of the Neumann series is explored in order to
16 derive lower and upper bounds for expected value and second order moment of the stochastic
17 temperature and displacement responses. Uncertainties in axial stiffness and conductivity are
18 represented as parameterized stochastic processes. Monte Carlo simulation is employed to obtain a
19 few samples of the stochastic temperature and displacement fields, from which lower and upper
20 bounds of expected value and second order moment are computed. The proposed methodology is
21 applied to two linear one-dimensional thermo-elastic example problems. It is shown that accurate
22 and efficient bounds can be obtained, for a proper choice of operator norm, with as few as one or two
23 terms in the Neumann expansion. The Monte Carlo – Neumann bounding scheme proposed herein is
24 shown to be an efficient alternative for the solution of stochastic thermo-elasticity problems.

25

26 **keywords:** Neumann series; Monte Carlo simulation; thermo-elasticity; stochastic processes.

27

28 **1. INTRODUCTION**

29 The last few decades have witnessed tremendous developments in the modeling of mechanical and
30 structural systems, due to advances in computational mechanics. Numerical methods such as finite
31 elements, finite difference, boundary elements, etc., have reached broad acceptability and wide

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