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Evaluation of elastic coefficients from the correlation and spectral tensors in respond to boundary random excitations

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We study the correlation structure of solutions to Laplace and Lamé equations in respond to random boundary conditions of Dirichlet and Neumann type, both in two and three dimensions. Explicit formulae for the correlation functions are obtained when the random excitations are homogeneous random fields on a sphere (disc, in 2D). Even if the input boundary excitation is a white noise random field, the solution is not a homogeneous random field. However we obtain an explicit Karhunen-Loeve expansion of these fields, which turn to be partially homogeneous, that means, they are statistically homogeneous with respect to the angular variable. The same analysis is made for the half space in two and three dimensions. The main results are devoted to a vector case of elastic deformations. Here we study the correlation structure of the displacement vector for an elastic disc with random excitations on the boundary. It is shown that from the correlation and spectral tensor structure, we can extract the information about the elastic coefficients. The method is based on the Random Walk approach [1].

[1] K.K.Sabelfeld. Monte Carlo methods in boundary value problems. Springer Verlag. New York - Heidelberg - Berlin, 1991.