WAVE SCATTERING BY RANDOMLY PERTURBED PERIODIC GRATINGS VIA SPARSE TENSOR BEM

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Abstract. Grating structures have been considered in many applications, such as spectroscopy and energy conversion devices. Exhaustive theoretical and numerical analyses have been performed in order to design gratings optimally. However, real-life manufacturing processes can create random variations on the surface that greatly influence the properties of the gratings. In this work, we implement a numerical algorithm based on the Boundary Element Method (BEM) for randomly perturbed ideal surfaces, considering one dimensional gratings with Gaussian rough surfaces and satisfying Dirichlet boundary conditions. We calculate first and second statistical moments of the scattered field with a sparse tensorization and a discretization based on wavelets. Calculations are provided for different geometries and angles of incidence and show that our method converges significantly faster than taking Monte-Carlo (MC) simulations for BEM.

Keywords: Electromagnetic Scattering, Uncertainty Quantification, Periodic Structures,

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