MULTI-LEVEL CONDITIONAL SIMULATION OF TWO-DIMENSIONAL RANDOM PROCESSES USING HAAR WAVELETS

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This paper introduces an algorithm for the conditional simulation of two-dimensional isotropic random processes using Haar wavelets. Global accuracy is evaluated via two test data sets.

The random process to be simulated is assumed to be Gaussian and so non-Gaussian data need to be suitably transformed before the application of the algorithm and back transformed at the conclusion of the algorithm.

The algorithm is based on stochastic wavelet analysis and makes use of both continuous and discrete wavelet transforms. The continuous wavelet transform is used to estimate the wavelet spectrum which is approximately equal to the variance of the wavelet coefficients. The inverse discrete wavelet transform (IDWT) is used to reconstruct the values of the process from the simulated wavelet and scaling coefficients.

This is a multi-level simulation where the scaling coefficients and wavelet coefficients at some coarse scale are simulated. The scaling image at the finer scale is reconstructed via IDWT. The process is recursively done until the original level is reached.

KEY WORDS: Stochastic wavelet analysis, wavelet spectrum, global accuracy, spatial correlation.