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Wavelet-based codification between high and low-resolution imagery

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Using a parametric texture model, we obtain a statistical codification between high and low-resolution imagery. The method lies in a kernel interpolation between wavelet coefficients obtained from texture decomposition of both high and low-resolution tomographies of an analog model. Synthetic signals are resolved by means of an inversed transformation of random wavelet coefficients, prior to the kernel. The coefficient simulation proceeds in 4 main steps, namely, statistical analysis to the fourth moment of low-resolution tomographies, wavelet decomposition of these images into wavelet coefficients, extraction of the probability density function contained within the prior kernel that corresponds to the obtained wavelet coefficients, drawing of the synthetic wavelet coefficients from the corresponding cumulative density function by means of a normal random distribution. Final simulations are obtained by inverse wavelet transform of the drawn coefficients and constrained using a detailed objective function. As a first case-study, we simulate a high-resolution near-surface soil porosity prior to numerical ground-penetrating radar tomographies. As a second case study, we simulate ex vivo high-resolution micro-computed tomography (uCT scan) using non-invasive in vivo magnetic resonance imagery (MRI). We compare our results to expected images and common geostatistical/biomedical methods.