Stochastic Discrete Element Model — Random Field

Random fields of strength and fracture energy

$$egin{aligned} f_t(oldsymbol{x}) &= ar{f}_t h(oldsymbol{x}) & f_s(oldsymbol{x}) &= ar{f}_s h(oldsymbol{x}) \ G_t(oldsymbol{x}) &= ar{G}_t \left[h(oldsymbol{x})
ight]^2 & G_s(oldsymbol{x}) &= ar{G}_s \left[h(oldsymbol{x})
ight]^2 \end{aligned}$$

$$\rho_{ij} = \exp\left(-||x_i - x_j||^2/d^2\right)$$

Random variable h(x) follows a Gauss-Weibull cdf.

Generate std. Gaussian field by using the optimal linear estimation method (Li and Der Kiureghian 1993)

$$\bar{h}(x) = \sum_{i=1}^{N} \frac{\epsilon_k}{\sqrt{\lambda_i}} \psi_i^T C_{cq}$$

Then transform it back to non-Gaussian field h(x).



Auto-correlated random field generated on a grid and then projected onto the grain boundaries.