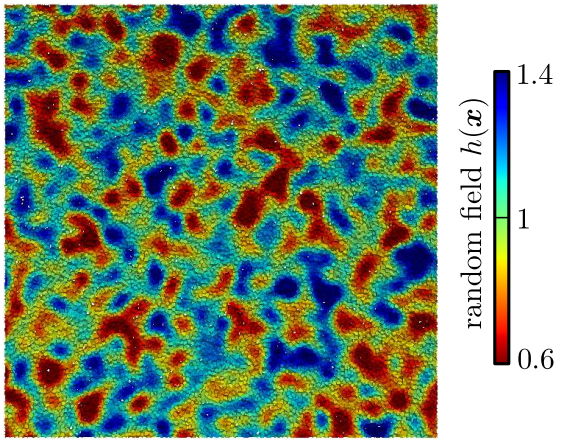
Stochastic Discrete Element Model — Random Field

Random fields of strength and fracture energy

$$f_t(\boldsymbol{x}) = \bar{f}_t h(\boldsymbol{x}) \qquad f_s(\boldsymbol{x}) = \bar{f}_s h(\boldsymbol{x})$$

$$G_t(\boldsymbol{x}) = \bar{G}_t \left[h(\boldsymbol{x})\right]^2 \qquad G_s(\boldsymbol{x}) = \bar{G}_s \left[h(\boldsymbol{x})\right]^2$$

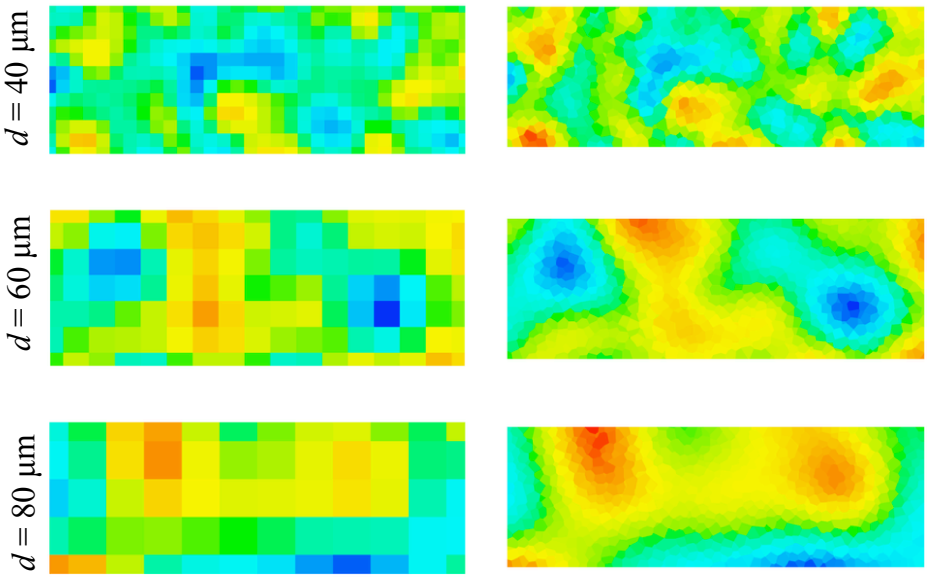


$$\rho_{ij} = \exp\left(-||x_i - x_j||^2/d^2\right)$$

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.