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# Numerical homogeneisation of diffusive transport in two-phase materials.

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Engineered materials are often composite and natural materials are mostly heterogeneous and polyphase. Yet, numerous experimental and theoretical approaches of diffusive transport address single-phase, homogeneous or at best periodic composite media. The results of such studies are hardly applicable to natural systems. Homogeneization may be an adequate way to obtain bulk transport properties of composite materials from the properties of their constituent phases, providing consideration of the appropriated microstructures (phase- amount, size and distribution).We present original finite element modeling of unidirectional bulk transport properties in two-phase materials composed of equant, but randomly distributed inclusions in a matrix. In addition to the mean field solution (macroscopic bulk transport) we provide the local transport gradients, which are associated with the random microstructure. For illustration, the model is applied to ionic transport in fluid saturated porous rocks. This method can be applied to investigate preferential transport paths within thin sections from oriented natural samples and, thus, predict larger scale transport anisotropy.