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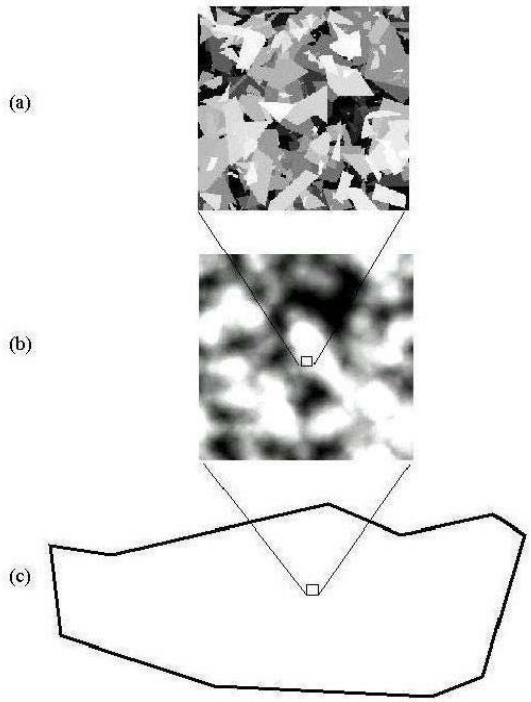

Fig. 1: Passage from (a) microscale, through (b) mesoscale, to (c) macroscale.

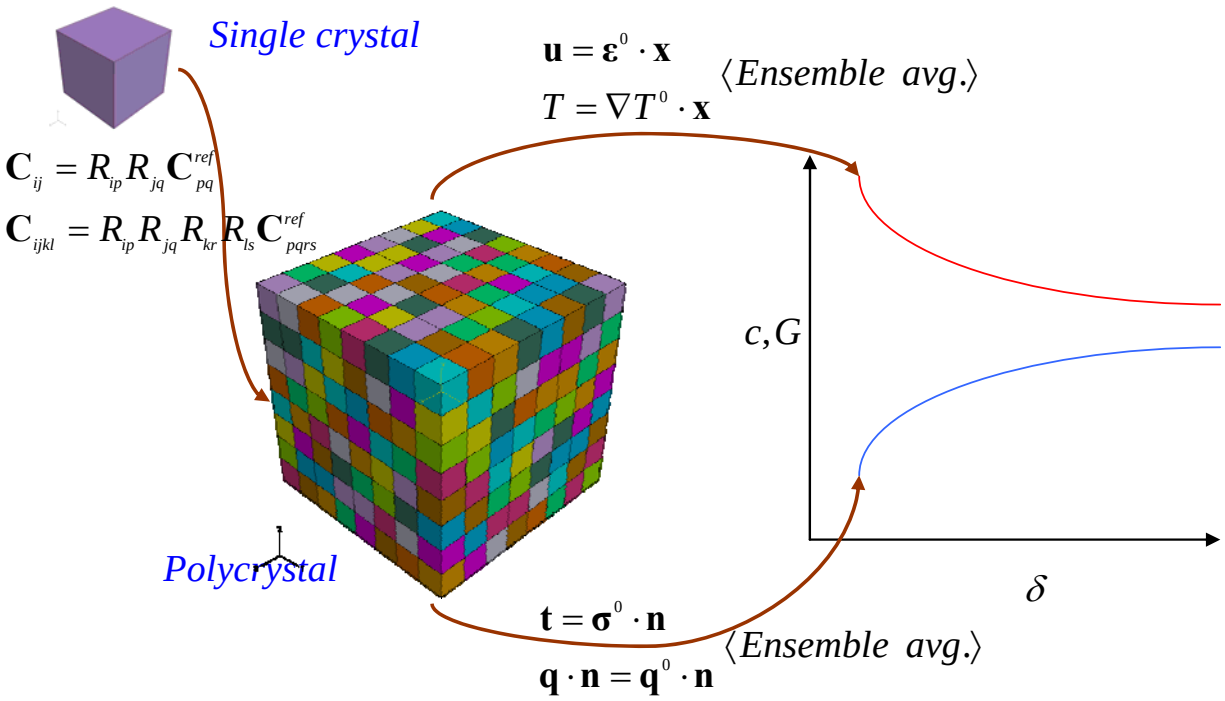

Fig. 2: Homogenization methodology for second- and fourth-rank tensors. In general, **C** (**S**) represents the conductivity (resistivity) tensor or the elastic modulus (compliance) tensor depending upon the context (heat conduction or elasticity); after [S.I. Ranganathan and M. Ostoja-Starzewski, "Towards scaling laws in random polycrystals," *Int. J. Eng. Sci.* **47**, 1322–1330, 2009].

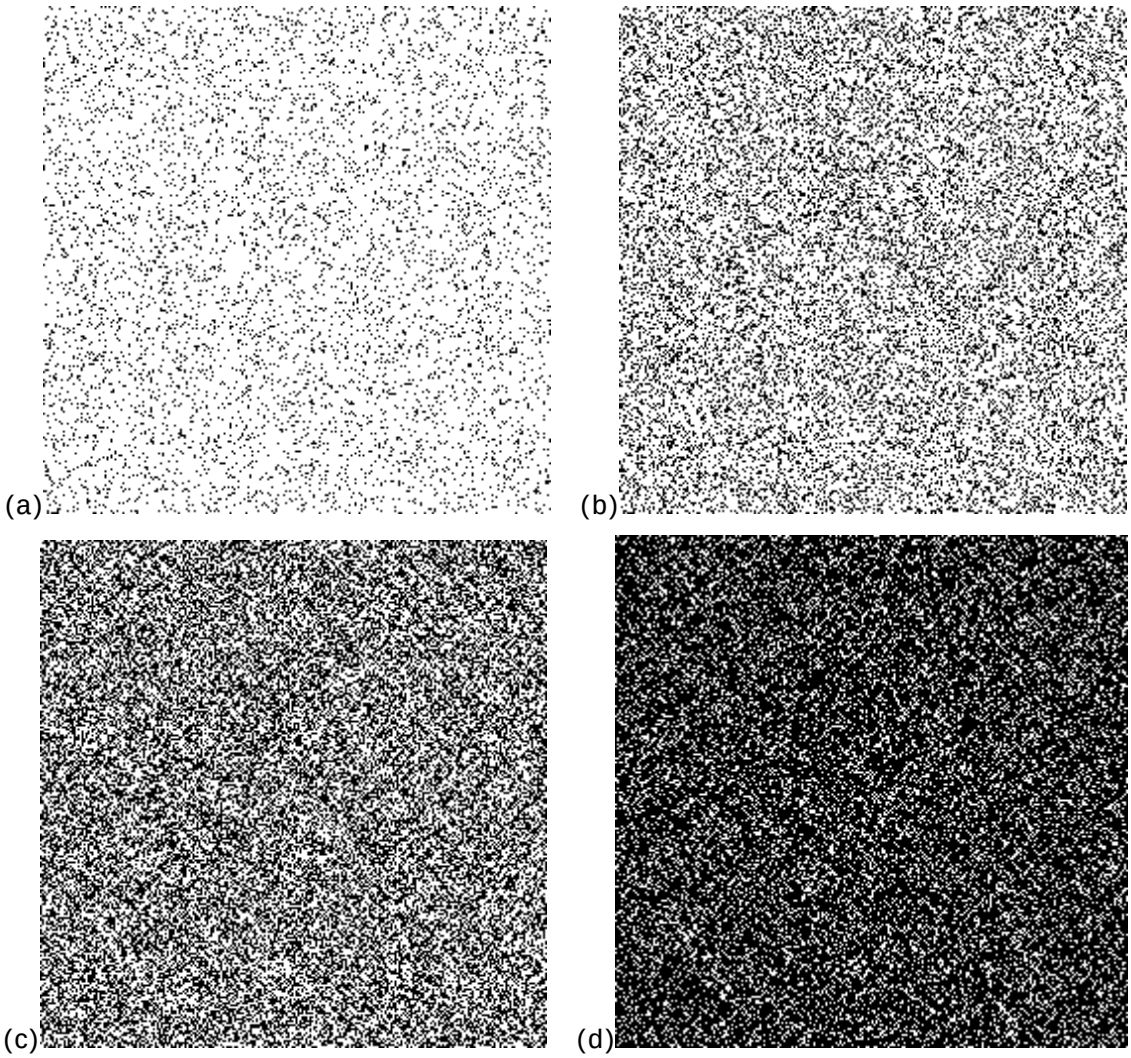

Fig. 3: Morphogenesis of a fractal at elastic-plastic transition in a weakly random material; after [J. Li and M. Ostoja-Starzewski, “Fractals in elastic-hardening plastic materials,” *Proc. R. Soc. Lond. A* **466**, 603-621, 2010].