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Abstract
The article discusses the 2D problem of manufacturability of the minimum compliance designs of the structural elements made of inhomogeneous materials of local isotropic or square symmetry properties. The available isotropic material design (IMD) and cubic material design (CMD) methods deliver the optimal distribution of the elastic moduli within the design domain. Within the 2D setting, the cubic symmetry reduces to the symmetry of a square. The varying underlying microstructures corresponding to the optimal designs are recovered by matching the values of the optimal moduli with the values of the effective moduli of the representative volume elements (RVEs) computed by the asymptotic homogenization method for periodic media. The shape of the RVE and its internal symmetries are properly selected providing assumed isotropy or symmetry of a square of the homogenized constitutive tensor. The microstructure topology is described by parametric description of single (or several) fibers in RVE. The periodicity of the structure and the final topology of the material within RVE is ensured by multiplication of a single fiber in accordance with the symmetries adopted for RVE. The ability to model an auxetic behavior within the subdomains where the optimal Poisson's ratio assumes negative values is shown.