The energy-momentum tensor in compatible and incompatible elasticities

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Abstract

We revisit Eshelby's (energy-momentum) tensor for various constitutive relations: linear and nonlinear, local, nonlocal and gradient elastic, piezoelectric and piezomagnetic, and micropolar and micromorphic continua. We discuss the general field theoretical aspect, the configurational forces, the canonical form derivable with different gauges: all with reference to the construction of so called path-independent integrals. As concrete example of the configurational forces acting on the sources of the various fields and material inhomogeneities we elaborate on the thermodynamic driving force for bone growth and remodelling.

Keywords: Eshelby stress tensor; Configurational forces; Micromorphic elasticity; Micropolar elasticity; Nonlocal elasticity; Gradient elasticity.