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Flow-Evolutionary Hypothesis based on Field Theory of Multiscale Plasticity (FTMP) and Its Applications

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This study proposes a working hypothesis named "flow-evolutionary law" that relates FTMP (Field Theory of Multiscale Plasticity)-based incompatibility tensor with the fluctuation part of energy-momentum tensor, for visualizing inter/trans-scale flow of energy and the attendant local plastic flow responsible for the evolutions of multi-scale inhomogeneity. Basic idea of FTMP as well as the descriptive capability of a FTMP-based incompatibility model, in particular, is firstly overviewed by showing some recent application examples. Such phenomenal features of FTMP enable us to model most of the existing "microscopic degrees of freedom (M-DOF)" necessary for describing, reproducing and/or predicting the micro-/sub-structural evolutions occurring during elasto-plastic deformation of materials, which will be indispensable for accomplishing practically-feasible multiscale modeling of materials.

Keywords: Field theory, Multiscale, Crystal plasticity, Incompatibility tensor, Continuum mechanics