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Field theoretical approach to deformation dynamics. SANICHIRO YOSHIDA, Southeastern Louisiana University — Based on a recent gauge theory called physical mesomechanics, an attempt is made to formulate the deformation dynamics of solid-state materials comprehensively. In this formalism, deformation is described as a linear transformation of the position vector connecting two nearby points of the material; the transformation is global in the elastic regime and local in the plastic regime. Request of local invariance leads to a Maxwell type field equation, in which a symmetry charge analogous to the electric charge is defined. Dynamics in the plastic regime is characterized by transverse force proportional to rotational displacement, as opposed to translational displacement in the elastic regime, and longitudinal force proportional to velocity. The transverse force is a restoring force, which can be interpreted as the recoverability mechanism that the material regains in the plastic regime. The longitudinal force can be interpreted as a field force acting on the above-mentioned charge, which is basically an energy dissipating force causing the irreversibility of plastic deformation. Fracture is considered to be the situation where the material completely loses recoverability. Supporting experimental data will be presented.

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