Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Euler-Lagrange Elasticity: elasticity without stress or strain HUMPHREY HARDY, Piedmont College — A Euler-Lagrange (E-L) approach to elasticity is proposed that produces differential equations of elasticity without the need to define stress or strain tensors. The positions of the points within the body are the independent parameters instead of strain. Force replaces stress. The advantage of this approach is that the E-L differential equations are the same for both infinitesimal and finite deformations. Material properties are expressed in terms of the energy of deformation. The energy is expressed as a function of the principal invariants of the deformation gradient tensor. This scalar invariant representation of the energy of deformation enters directly into the E-L differential equations so that there is no need to define fourth order tensor material properties. By experimentally measuring the force and displacement of materials the functional form of the energy of deformation can be determined. The E-L differential equations can be input directly into finite element, finite difference, or other numerical models. If desired, stress and stain can be calculated as dependent parameters.

Humphrey Hardy
Piedmont College

Date submitted: 14 Nov 2013 Electronic form version 1.4