Abstract Submitted
for the SES15 Meeting of
The American Physical Society

Comprehensive theory of deformation and fracture SANICHIRO YOSHIDA, Southeastern Louisiana University — Based on the principle of local symmetry applied to Hooke's law, deformation and fracture of solids are being theorized in a comprehensive fashion. Allowing coordinate dependence in the transformation matrix representing local linear elasticity and requesting that the dynamics be described at the global level in the same form as the local level, a connection field is introduced. With the use of the Lagnrangian formalism, a set of field equations are derived. The field equations yield wave solutions that represent wave dynamics of deformation of all regimes. Dynamics of different regimes can be differentiated as difference in the mechanism of longitudinal recovery force. Elastic deformation is characterized by a longitudinal wave associated with longitudinal spring force; plastic deformation is characterized by a decaying transverse wave associated with transverse (shear) recovery force and longitudinal damping force; and elasto-plastic deformation is characterized by a solitary wave resulting from a combination of the elastic and plastic dynamics. Experiments have been conducted with the use of optical interferometry to measure the displacement field of specimens under tensile loads. Wave dynamics of all the regimes have been observed experimentally.

Sanichiro Yoshida
Southeastern Louisiana University

Date submitted: 15 Oct 2015 Electronic form version 1.4