

Piola Transformation of Stress and Double Stress in Second Gradient Continua

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Second gradient continua are continua with internal virtual work contributions that depend linearly and continuously on the first and second gradient of the virtual displacement. These virtual work contributions can be postulated either in Lagrangian (referential) or Eulerian (spatial) form and define respectively the Piola-Lagrange stresses as well as the Cauchy-Euler stresses. We show how the principle of virtual work in Lagrangian form emerge as a generalization of the minimum of potential energy and derive the Piola transformation of the appearing stress contributions. We give in both the Eulerian and Lagrangian description the expression of surface and edge contact interactions for second Gradient continua in terms of the normal and the curvature of contact boundary surfaces and edge shapes. Moreover, we formulate the complete boundary value problems in both representation.