Unorthodox Thoughts about Deformation, Elasticity, and Stress

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The nature of elastic deformation is examined in the light of the potential theory. The concepts and mathematical treatment of elasticity and the choice of equilibrium conditions are adopted from the mechanics of discrete bodies, e. g., celestial mechanics; they are not applicable to a change of state. By nature, elastic deformation is energetically a Poisson problem since the buildup of an elastic potential implies a change of the energetic state in the sense of thermodynamics. In the Euler-Cauchy theory, elasticity is treated as a Laplace problem, implying that no change of state occurs, and there is no clue in the Euler-Cauchy approach that it was ever considered as one. The Euler-Cauchy theory of stress is incompatible with the potential theory and with the nature of the problem; it is therefore wrong. The key point in the understanding of elasticity is the elastic potential.

Key words: Potential Theory; Elasticity; Stress; Poisson Equation; Cauchy Theory.