Solution of S3 Problem of Deformation Mechanics for a Definite Condition and Resulting Modifications of Important Failure Theories

Authors : Ranajay Bhowmick

Abstract : Analysis of stresses for an infinitesimal tetrahedron leads to a situation where we obtain a cubic equation consisting of three stress invariants. This cubic equation, when solved for a definite condition, gives the principal stresses directly without requiring any cumbersome and time-consuming trial and error methods or iterative numerical procedures. Since the failure criterion of different materials are generally expressed as functions of principal stresses, an attempt has been made in this study to incorporate the solutions of the cubic equation in the form of principal stresses, obtained for a definite condition, into some of the established failure theories to determine their modified descriptions. It has been observed that the failure theories can be represented using the quadratic stress invariant and the orientation of the principal plane.