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Geometry of Stress Function Surfaces for an Asymmetric Continuum

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Abstract

A two-dimensional stress field of dislocation or fault is geometrically studied for an asymmetric continuum. For geometric surfaces of the stress and couple-stress functions, the mean and Gaussian curvatures are derived. The mean curvature of couple-stress function surface is connected with the asymmetric of stress tensor. Moreover, the Gaussian curvature of stress function surface is characterized by both the stress and couple-stress. On the other hand, the mean curvature of stress function surface is not affected by the asymmetry of stress. Based on these geometric expressions, the Coulomb's failure criterion and the friction coefficient are expressed by the curvatures of couple-stress function surface. Moreover, geometric structures of stress and couple stress function surfaces are shown for edge and wedge dislocations as faults. The curvatures of these surfaces show that the effect of couple-stress is constrained around the dislocations only.

Key words: asymmetric continuum, stress function, curvatures, Coulomb's failure criterion, dislocations.