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Plane deformations generating a prescribed finite rotation field GREGORY RIZZA, JANET BLUME, Brown University — Compatibility conditions for various strain measures are well known in both small and finite strain kinematics. For many problems, such conditions enable boundary value problems to be formulated using strains, stresses, or a generating potential function, as the fundamental dependent variable(s). These methods are effective, as most strain fields fully determine the generating deformations up to an arbitrary rigid deformation. Our research is concerned with the compatibility issue for the rotation field. Although it is not a direct measure of the distortion in a deformation, the rotation associated with a deformation and its variation from point to point within a body turns out to carry quite a bit of information about the actual deformation. For the case of plane deformation, we have been able to show that any suitably smooth plane proper orthogonal tensor field may serve as a finite rotation tensor for a generating deformation. We have developed several examples demonstrating this relationship between material deformation and rotation fields. Our results demonstrate in the case of plane deformation, any skew-symmetric two-dimensional tensor field can serve as a plane rotation field. The relation between the position-dependence of a rotation field and generating deformation information has implications in both mechanical twinning and shear banding.

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