Ideal Flow Theory for Pressure-Dependent Materials

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Ideal flows are solenoidal smooth plastic flows in which an eigenvector field associated everywhere with the greatest principal strain rate and stress is fixed in the material. The technological value of the ideal flow theory comes from its potential to provide rapid preliminary designs of deformation processes. The available theory of ideal flows is restricted to the rigid perfectly plastic Tresca solid (i.e. solids obeying Tresca's yield criterion and its associated flow rule). In the present paper, the double shearing model and the double slip and rotation model of pressure – dependent plasticity based on the Coulomb – Mohr yield criterion are considered under the conditions of plane strain and axial symmetry. It is assumed that the material is incompressible and material flow is stationary. Under these conditions it is shown that ideal flows exist. In particular, methods for calculating ideal flows developed for the rigid perfectly plastic Tresca solid are extended to the aforementioned models of pressure – dependent plasticity.