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Pseudo-Rigid Bodies Viewed as Globally Constrained Continua

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Pseudo-rigid bodies (or Cosserat points) are continua whose deformation gradient fields are restricted to be spatially homogeneous. The theory, initiated by Slawianowski, was elaborated upon by Cohen, Muncaster, MacSithigh, Rubin, and others, and has been successfully applied to a wide variety of problems. The purpose of the present paper is to show theoretically how such continua can maintain the assumed homogeneity of their deformation fields in the presence of arbitrarily applied loads. Pursuing ideas introduced by Antman, Marlow, and Podio-Guidugli, pseudo-rigid bodies are regarded here from the novel viewpoint of globally constrained continua. Roughly speaking, the pseudo-rigid continuum is an idealized reinforced body in which the Cauchy stress tensor at each point is the sum of an active stress, which is specified by a constitutive equation, and an indeterminate reactive stress, which takes on whatever values are necessary to maintain the homogeneity of the deformation field. Remarkably, the active stresses form an equilibrated system, while the reactive stresses satisfy the same equations as for rigid continua.

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