

# *Simple Extension of a Hypo-elastic Body of Grade Zero*

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**1. Introduction.** The constitutive equations of an isotropic hypo-elastic body, as defined by TRUESDELL (1955a), are

$$\begin{aligned} \bar{s}^{ik} g_{ki} = & h_0 d_k^k \delta_j^i + h_1 d_j^i + h_2 d_k^k s_j^i + h_3 M \delta_j^i \\ & + \frac{1}{2} h_4 (d_k^i s_j^k + s_k^i d_j^k) + h_5 d_k^k s_r^i s_j^r \end{aligned} \quad (1.1)$$

$$\begin{aligned} & + h_6 M s_j^i + h_7 N \delta_j^i + \frac{1}{2} h_8 (d_r^i s_m^r s_j^m + s_r^i s_m^r d_j^m) \\ & + h_9 M s_r^i s_j^r + h_{10} N s_j^i + h_{11} N s_k^i s_j^k, \end{aligned}$$

$$d_{i,j} = \frac{1}{2} (v_{i,i} + v_{j,i}), \quad M = s_j^i d_i^j, \quad N = s_j^i s_k^j d_i^k, \quad (1.2)$$

$$\bar{s}^{ik} = \frac{\partial s^{ik}}{\partial t} + v^m s_{,m}^{ik} - s^{im} v_{,m}^k - s^{mk} v_{,m}^i + s^{ik} d_m^m, \quad (1.3)$$

where  $g_{ik}$  is the covariant metric tensor of a general fixed system of coordinates,  $v_i$  is the covariant velocity vector,  $2\mu s_j^i$  is the stress tensor,  $\mu$  being the rigidity modulus of classical elasticity, and where a comma denotes covariant differentiation. Also  $h_1, h_2, \dots, h_{11}$  are dimensionless analytic functions of the principal invariants of  $s_j^i$ . To complete the system of differential equations we add the equations of motion and continuity in the form

$$2\mu s_{,i}^{ij} = \rho \left( \frac{\partial v^i}{\partial t} + v^i_{,j} v^j \right), \quad (1.4)$$

$$\frac{\partial \rho}{\partial t} + (\rho v^i)_{,i} = 0,$$

where  $\rho$  is the density and body forces are zero.