Weak Solvability of One Problem of Fractional Viscoelasticity Model with Memory

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Abstract: We consider the motion of a multidimensional viscoelastic continuum which subjects anti-Zener fractional constitutive law. The weak solvability of a corresponding initial-boundary value problem is established. The corresponding initial-boundary value problem has the form:

(1)

$$\partial v/\partial t + \sum_{i=1}^{N} v_i \partial v/\partial x_i - \mu_0 \mathrm{Div}\, \mathcal{E}(v) - \mu_1 \mathrm{Div} \int_0^t R_1(t,\tau)\, \mathcal{E}(v)(\tau, z(\tau;t,x))\, d\tau$$

$$-\mu_2 \mathrm{Div} \int_0^t R_2(t,\tau)\, \mathcal{E}(v)(\tau, z(\tau;t,x))\, d\tau + \nabla p = f,\ \mathrm{div}\, v = 0,\ (t,x) \in Q_T;$$

$$z(\tau;t,x) = x + \int_t^\tau v(s, z(s;t,x))\, ds, \quad 0 \le t, \tau \le T, \quad x \in \overline{\Omega}; \tag{2}$$

$$v(0,x) = v^0(x),\ x \in \Omega;\ v|_{[0,T]\times\partial\Omega} = 0, \tag{3}$$

where kernels $R_2(t,\tau)$ are singular.

Keywords: Viscoelastic continuum, motion equations, initial-boundary value problem, weak solution, fractional derivative, regular Lagrangian flow

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References

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