Trajectory and global attractors for termo-Voigt model

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Abstract: Let Ω be bounded domain in the space $\mathbb{R}^n$, $n = 2,3$, with a smooth boundary $\partial\Omega$. We consider the following initial-boundary value problem

$$\frac{\partial v}{\partial t} + \sum_{i=1}^{n} v_i \frac{\partial v}{\partial x_i} - 2\mathrm{Div}(\nu(\theta)\mathcal{E}(v)) - \varkappa \frac{\partial \Delta v}{\partial t} + \nabla p = f; \tag{1}$$

$$\mathrm{div}\, v = 0; \qquad v|_{t=0} = v_0, \quad x \in \Omega; \qquad v|_{\partial\Omega\times[0,+\infty]} = 0; \tag{2}$$

$$\frac{\partial \theta}{\partial t} + \sum_{i=1}^{n} v_i \frac{\partial \theta}{\partial x_i} - \chi\Delta\, \theta = 2\nu(\theta)\mathcal{E}(v) : \mathcal{E}(v) + 2\varkappa \frac{\partial \mathcal{E}(v)}{\partial t} : \mathcal{E}(v) + g; \tag{3}$$

$$\theta|_{t=0} = \theta_0, \quad x \in \Omega; \qquad \theta|_{\partial\Omega\times[0,+\infty]} = 0. \tag{4}$$

Here, $v = (v_1(t,x), \dots, v_n(t,x))$ is un unknown vector-valued velocity function of particles in the fluid, $p = p(t,x)$ is un unknown pressure, $f = f(t,x)$ is the external force. The divergence $\mathrm{Div}\, C$ of the tensor $C = (c_{ij}(t,x))$ is the vector with with coordinates $(\mathrm{Div}\, C)_j = \sum_{i=1}^{n}(\partial c_{ij}/\partial x_i)$;

$$\mathcal{E}(v) = (\mathcal{E}_{ij}(v)), \quad \mathcal{E}_{ij}(v) = \frac{1}{2}\left(\frac{\partial v_i}{\partial x_j} + \frac{\partial v_j}{\partial x_i}\right), \quad i,j = \overline{1,n},$$

is the strain-rate tensor; $\nu > 0$ is the fluid viscosity, $\varkappa$ is the retardation time, v_0 and θ_0 are given functions.

Theorem 1. *The trajectory space $\mathcal{H}^+$ of problem* (**??**)-(**??**) *has the minimal trajectory attractor $\mathcal{U}$ and the global trajectory attractor $\mathcal{A}$.*

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References

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