Cioranescu, D.; **Ouazar, El Hacène**

Existence and uniqueness for fluids of second grade. (English) Zbl 0577.76012

Nonlinear partial differential equations and their applications, Coll. de France Semin., Paris 1982-83, Vol. VI, Res. Notes Math. 109, 178-197 (1984).

[For the entire collection see Zbl 0543.00005.]

Consider the following initial boundary value problem (IVP) for the motion of a second grade fluid

$$\partial u/\partial t-\nu\Delta u-\alpha(\partial/\partial t)\Delta u+\operatorname{curl}(u-\alpha\Delta u)\wedge u=f-\nabla p;\quad \operatorname{div}\, u=0$$

where f is given and $p=\alpha(u\cdot\Delta u+1/4|\nabla u|^2)-1/2|u|^2-\tilde{p}$; $u=0$ on $\partial\Omega$; $u(x,0)=u_0(x)$ and Ω is a domain in $\mathbb{R}^n$.

Let V be the closure in $[H^1(\Omega)]^n$ of the divergence free vectors in $[\mathcal{D}(\Omega)]^n$ and let W be the divergence free vectors in $[H^3(\Omega)]^n$ vanishing on $\partial\Omega$. Let $T>0$ be given. Then, for $\Omega\subset\mathbb{R}^2$, f given in $L^2(0,T;V)$ and u_0 in V, the authors prove the existence and uniqueness of solutions in $L^\infty(0,T;W)$ for the IVP. For $\Omega\subset\mathbb{R}^3$ a bounded domain, f in $L^2(0,T;V)$ and u_0 in W, existence and uniqueness of solutions in $L^\infty(0,T^*;W)$ for the IVP were proved for $T^*<T$ sufficiently small.

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