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EVOLUTION STOKES SYSTEM OF THE THIRD ORDER WITH VARIABLE EXPONENT OF NONLINEARITY

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Let $n \in \mathbb{N}$ and $T > 0$ be fixed numbers, $n \geq 2$, $\Omega \subset \mathbb{R}^n$ be a bounded domain with the smooth boundary $\partial\Omega$, $Q_{0,T} = \Omega \times (0,T)$.

We consider the problem of finding a pair of functions $\{u, \pi\}$ that satisfy the following relations:

$$u_{tt} - \sum_{i,j=1}^{n} \Big(A_{ij}(x,t) u_{tx_i}\Big)_{x_j} - \sum_{i,j=1}^{n} \Big(B_{ij}(x,t) u_{x_i}\Big)_{x_j} + G(x)|u_t|^{q(x)-2} u_t +$$

$$+ \int\limits_{\Omega} \mathfrak{Z}(x,t,y) u_t(y,t)\, dy + \nabla\pi = f(x,t) \quad \text{in} \quad Q_{0,T}, \tag{1}$$

$$\operatorname{div} u = 0 \quad \text{in} \quad Q_{0,T}, \tag{2}$$

$$\int\limits_{\Omega} \pi(x,t)\, dx = 0 \quad \text{in} \quad (0,T), \tag{3}$$

$$u|_{\partial\Omega \times [0,T]} = 0, \tag{4}$$

$$u|_{t=0} = u_0(x) \quad \text{in} \quad \Omega, \tag{5}$$

$$u_t|_{t=0} = u_1(x) \quad \text{in} \quad \Omega, \tag{6}$$

where $u = (u_1, \dots, u_n) : Q_{0,T} \to \mathbb{R}^n$ is the velocity field, $\pi : Q_{0,T} \to \mathbb{R}$ is the pressure, $\nabla\pi = (\frac{\partial\pi}{\partial x_1}, ..., \frac{\partial\pi}{\partial x_n})$, $\operatorname{div} u = \frac{\partial u_1}{\partial x_1} + ... + \frac{\partial u_n}{\partial x_n}$, A_{ij}, B_{ij} $(i,j = \overline{1,n})$, G, $\mathfrak{Z}$ are some matrices, f is some vector function. The function $q(\geq 1)$ is called the variable exponent of nonlinearity to the equation (1).

Under additional conditions for data-in, we prove the solvability of problem (1)–(6).

http://iapmm.lviv.ua/mpmm2023/materials/ma09_18.pdf