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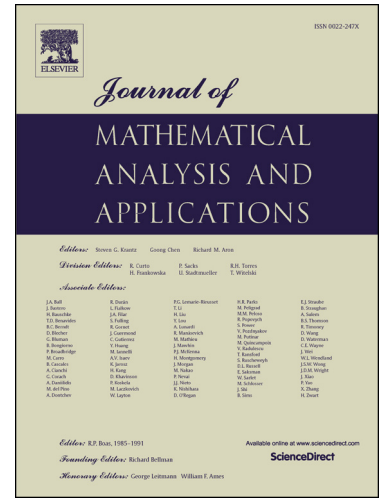
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# Global regularity of the generalized liquid crystal model with fractional diffusion

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## Abstract

In this paper, we consider the global regularity for a  $n$ -dimensional generalized liquid crystal system with fractional diffusion term  $\zeta^2 u$  for the velocity field, where  $\widehat{\zeta u}(\xi) = \frac{|\xi|^\alpha}{g(|\xi|)} \widehat{u}(\xi)$  and  $g^2(|\xi|) \leq C_0 \log(e + |\xi|)$  for  $\alpha \geq 1 + \frac{n}{2}$ . This paper provides a global regularity result for the generalized liquid crystal equations, which extends the result given by Jin, Zhu and Jin to the case  $\beta = 0$  for  $n = 2$  (Global existence of solutions to the 2D incompressible liquid crystal flow with fractional diffusion, J. Math. Anal. Appl., 425(2015), 726-733).

**Key words:** liquid crystal model, fractional diffusion, global regularity.

**MSC(2000):** 35Q35, 35B65.

## 1 Introduction

In this paper, we consider the following  $n$ -dimensional incompressible generalized liquid crystal equations

$$\begin{cases} \frac{\partial u}{\partial t} + u \cdot \nabla u + \mu \wedge^{2\alpha} u + \nabla p = -\lambda \nabla \cdot (\nabla d \odot \nabla d), \\ \frac{\partial d}{\partial t} + u \cdot \nabla d + \gamma \wedge^{2\beta} d = -f(d), \\ \operatorname{div} u = 0, \\ u(x, 0) = u_0, \quad d(x, 0) = d_0, \end{cases} \quad (1.1)$$

where  $u$  is the fluid velocity field,  $d$  stands for the macroscopic average of orientation field,  $p$  is the scalar pressure,  $f(d) := (|d|^2 - 1)d$ .  $\mu$  is the kinematic viscosity,  $\lambda$  is the competition between the kinetic and potential energies, and  $\gamma$  is the microscopic elastic relation time for the molecular orientation field, and  $\wedge$  is defined by  $\widehat{\wedge f}(\xi) = |\xi| \widehat{f}(\xi)$ , where  $\widehat{f}(\xi)$  denotes the Fourier transform of  $f(x)$ .

Here, the following tensorial notation is used:

$$(\nabla d \odot \nabla d)_{ij} = \sum_{k=1}^n \partial x_i d_k \partial x_j d_k, \quad \forall i, j = 1, 2 \cdots n.$$

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