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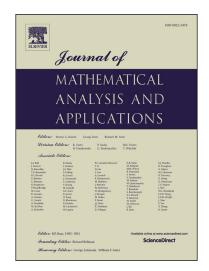
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### **ACCEPTED MANUSCRIPT**

# Components reduction regularity results for the Navier-Stokes equations in general dimensions

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#### Abstract

We consider the Cauchy problem of the Navier-Stokes equations in arbitrary dimensions, and establish several new components reduction regularity criteria.

Keywords: Navier-Stokes equations, blow-up criterion, vorticity

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#### 1. Introduction

In this paper, we study the Navier-Stokes system in  $\mathbb{R}^N$   $(N \ge 3)$ :

$$\begin{cases}
\partial_t \boldsymbol{u} + (\boldsymbol{u} \cdot \nabla) \boldsymbol{u} - \Delta \boldsymbol{u} + \nabla \pi = \boldsymbol{0}, \\
\nabla \cdot \boldsymbol{u} = 0, \\
\boldsymbol{u}|_{t=0} = \boldsymbol{u}_0,
\end{cases} \tag{1}$$

where  $\boldsymbol{u}(t,x)=(u_1,u_2,\cdots,u_N)$  is the fluid velocity field;  $\pi(t,x)$  is a scalar pressure, playing the role of Lagrange multiplier associated with the isochoricity constraint  $\nabla \cdot \boldsymbol{u}=0$ ;  $\boldsymbol{u}_0(x)$  is the prescribed initial data satisfying the compatibility condition  $\nabla \cdot \boldsymbol{u}_0=0$ . Here,  $(\boldsymbol{u}\cdot\nabla)\boldsymbol{u}=\sum_{i=1}^N u_i\partial_i\boldsymbol{u}$ 

is convection term with  $\partial_i = \frac{\partial}{\partial x_i}$ ;  $\Delta \boldsymbol{u} = \sum_{i=1}^N \partial_i^2 \boldsymbol{u}$  is the Laplacian of the velocity, representing the diffusion effect of the fluid.

It is well-known that for initial data  $u_0 \in W^{s,p}(\mathbb{R}^N)$  with  $2 \leq p < \infty$ ,  $s > \frac{N}{p} - 1$ , (1) possesses a unique local strong solution

$$\mathbf{u} \in C([0,T); W^{s,p}(\mathbb{R}^N)) \cap C^1((0,T); W^{s,p}(\mathbb{R}^N)) \cap C((0,T); W^{s+2,p}(\mathbb{R}^N)) \equiv CL_{s,p}(0,T),$$
 (2)

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