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$$\Omega \subset R^3$$

$$\frac{\partial v}{\partial t} = \mu \operatorname{div} v - \nabla p + f, \tag{1}$$

$$\operatorname{div} v = 0, \tag{2}$$

$$v|_{t=0} = v_0(x), \quad v|_S = 0, \tag{3}$$

S_1

Ω_1

(1)-(3)

$$D = \Omega \cup D_0$$

$S_1 \cap S = \emptyset$

$$\frac{\partial v^\varepsilon}{\partial t} = \mu \Delta v^\varepsilon - \nabla p^\varepsilon + f - \frac{\xi(x)}{\varepsilon} v^\varepsilon, \tag{4}$$

$$\operatorname{div} v^\varepsilon = 0, \tag{5}$$

$$v^\varepsilon|_{t=0} = v_0(x), \quad v^\varepsilon|_{S_1} = 0, \tag{6}$$

$$\xi(x) = \begin{cases} 0, & x \in \Omega \\ 1, & x \in D_0 = D \setminus \Omega \end{cases} \tag{7}$$

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