

*Asymptotic Expansions of Navier-Stokes Solutions for Small Reynolds Numbers**

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Introduction. The present paper and Ref. 1 are essentially based on Ref. 2. Some of the basic ideas of Ref. 2 have been described and applied in Ref. 3; pp. 872–877 in particular may serve as an introduction to the present paper and to Ref. 1. A concrete application of the ideas described below is given in Ref. 1.

We consider viscous incompressible stationary flow past an arbitrary finite body in two or three dimensions. The following notation is used

$$\begin{aligned} \mathbf{q} &= \text{velocity, } \rho = \text{density} = \text{constant, } p = \text{pressure, } \nu = \text{kinematic viscosity,} \\ L &= \text{characteristic length of body, } (x_i) = \text{Cartesian coordinates, } x = x_1, \quad (1) \\ r^2 &= \sum_{i=1}^n x_i^2 \text{ where } n \text{ is the dimension of the space.} \end{aligned}$$

The governing equations are the Navier-Stokes equations

$$\frac{D\mathbf{q}}{Dt} + \frac{1}{\rho} \nabla p = \nu \nabla^2 \mathbf{q}, \quad (2a)$$

$$\nabla \cdot \mathbf{q} = 0, \quad (2b)$$

with the boundary conditions

$$\mathbf{q} = \mathbf{0} \quad \text{at body,} \quad (3a)$$

$$\mathbf{q} = U\mathbf{i}, \quad p = p_\infty \quad \text{at infinity,} \quad (3b)$$

where \mathbf{i} is the unit vector in the x -direction. Non-dimensional quantities are defined as follows:

$$\text{Re} = \frac{UL}{\nu} \quad (\text{Reynolds number}), \quad (4a)$$

$$\mathbf{q}^* = \frac{\mathbf{q}}{U}, \quad (4b)$$

$$\tilde{x}_i = \frac{x_i U}{\nu}, \quad \tilde{r} = \frac{r U}{\nu} \quad (\text{Oseen variables}), \quad (4c)$$

* Research supported by Office of Naval Research, N6 ONR-244, T. O. VIII, Project No. 041-156.