5.2.2 Special solutions

Oseen solution Consider the Stokes equations (5.12) for a point-force

$$\boldsymbol{f}(\boldsymbol{x}) = \boldsymbol{F}\ \delta(\boldsymbol{x}). \tag{5.14}$$

In this case, the solution with standard boundary conditions (5.13) reads[6]

$$u_i(\boldsymbol{x}) = G_{ij}(\boldsymbol{x})\ F_j\ , \qquad p(\boldsymbol{x}) = \frac{F_j x_j}{4\pi|\boldsymbol{x}|^3} + p_\infty, \tag{5.15a}$$

where the Greens function G_{ij} is given by the Oseen tensor

$$G_{ij}(\boldsymbol{x}) = \frac{1}{8\pi\mu\,|\boldsymbol{x}|}\left(\delta_{ij} + \frac{x_i x_j}{|\boldsymbol{x}|^2}\right), \tag{5.15b}$$