Appendix B

We present the derivation of the expression (3.21) for the time relaxation $\tau_{\mathrm{do},1}$. Substitution of the equation (3.20) for the irreversible time evolution of the configurational variable Q into the Doi-Ohta relaxation equation (1.7a) gives

$$\frac{1}{\tau_{\mathrm{do},1}} = -\frac{l(\mathbf{r}_1)}{Q(\mathbf{r}_1)} \int_V d^3r_2\, M^{(2)',\mathrm{dif}}_{P\varepsilon}(\mathbf{r}_1,\mathbf{r}_2)\, \frac{1}{T(\mathbf{r}_2)}\,. \tag{B1}$$

Under the assumption of a homogeneous system, integration over the whole system size of the above expression gives

$$\frac{1}{\tau_{\mathrm{do},1}} = -\frac{l}{QVT} \int_V d^3r_1 \int_V d^3r_2\, M^{(2)',\mathrm{dif}}_{P\varepsilon}(\mathbf{r}_1,\mathbf{r}_2)\,. \tag{B2}$$

The general expression (3.19) for the coarse-grained friction matrix $M^{(2)',\mathrm{dif}}$ gives

$$\begin{aligned} M^{(2)',\mathrm{dif}}_{P\varepsilon}(\mathbf{r}_1,\mathbf{r}_2) &= \int \mathcal{D}x\, \rho_y[x] \int_V d^3r'_1 \int_V d^3r'_2\, \chi(\mathbf{r}_1-\mathbf{r}'_1)\,\chi(\mathbf{r}_2-\mathbf{r}'_2) \\ &\times \int_V d^3r_3 \int_V d^3r_4\, \frac{\delta\Pi_P[c](\mathbf{r}'_1)}{\delta c(\mathbf{r}_3)} M^{(1),\mathrm{dif}}_{c\epsilon}(\mathbf{r}_3,\mathbf{r}_4) \frac{\delta\Pi_\epsilon[\epsilon](\mathbf{r}'_2)}{\delta\epsilon(\mathbf{r}_4)}, \end{aligned} \tag{B3}$$

which after substitution of the appropriate functional derivatives, $M^{(1),\mathrm{dif}}$ element, and the integration over $\mathbf{r}_4$, $\mathbf{r}'_1$, and $\mathbf{r}'_2$ becomes

$$\begin{aligned} M^{(2)',\mathrm{dif}}_{P\varepsilon}(\mathbf{r}_1,\mathbf{r}_2) &= \int \mathcal{D}c\, \rho_{(Q,\mathbf{q})}[c] \int_V d^3r'\; 2\kappa_{\mathrm{E}} MT \frac{\partial}{\partial r'_\alpha}\left(\left(\frac{\partial^2 c}{\partial \mathbf{r}'^2}\right)\chi(\mathbf{r}_2-\mathbf{r}')\right) \\ &\times \frac{\partial^2}{\partial r'_\alpha \partial r'_\beta}\left(\frac{\partial c}{\partial r'_\beta}\chi(\mathbf{r}_1-\mathbf{r}')\right), \end{aligned} \tag{B4}$$

where we have used the assumption of a homogeneous ($M = \mathit{const.}$) and isothermal system, as well as the approximations based on a difference between the Cahn-Hilliard and Doi-Ohta length scales, as in Appendix A. Substitution of the friction matrix element (B4) into equation (B2), gives after using the normalization condition $\int_V d^3r'\ \chi(\mathbf{r}-\mathbf{r}') = 1$, the final formula for the Doi-Ohta time relaxation

$$\frac{1}{\tau_{\mathrm{do},1}} = \frac{2\kappa_{\mathrm{E}} Ml}{VQ} \int \mathcal{D}c\, \rho_{(Q,\mathbf{q})}[c] \int_V d^3r \left[\frac{\partial}{\partial \mathbf{r}}\left(\frac{\partial^2 c(\mathbf{r})}{\partial \mathbf{r}^2}\right)\right]^2. \tag{B5}$$

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[1] R. G. Larson, *The Structure and Rheology of Complex Fluids* (Oxford University Press, New York, 1999).