Free Energy of the Binary XPFC Model

The free energy of the binary xpfc model can be written as,

$$\frac{\beta\mathcal{F}[n,c]}{\rho_0} = \int dr\ \frac{n^2}{2} - \chi\frac{n^3}{6} + \eta\frac{n^4}{12} + \frac{W_c}{2}|\nabla c|^2 + (1+n)\Delta f_{mix}(c) - \frac{1}{2}n\int dr' C^n_{eff}(r-r';c)n(r'). \quad (1)$$

Where the free energy of mixing is,

$$\Delta f_{mix}(c) = \omega\left(c\ln\left(\frac{c}{c_0}\right) + (1-c)\ln\left(\frac{1-c}{1-c_0}\right) + \frac{\epsilon(T)}{2}(c-c_0)^2\right). \quad (2)$$

We assume that both the total density, n, and the concentration, c, follow conservative, diffusive dynamics to relax to equilibrium.

$$\frac{\partial c}{\partial t} = M_c\nabla^2() \quad (3)$$