[2018-06-07]

Spinodal decomposition

$h_0 = -M_0 \nabla \mu_0$ $\qquad M_0$ positive semidefinite

$$\mu_0 = \hat{\mu}_{ch}(c) + \frac{\alpha}{\rho_0}\left(J_p + \varphi_e(F)\right)$$

$$\frac{d}{dt}\varphi_{ch}(c) = \rho_0 \hat{\mu}_{ch}(c)\,\dot{c} \quad \Leftrightarrow \quad \frac{d}{dc}\varphi_{ch}(c) = \rho_0 \hat{\mu}_{ch}(c)$$

$$\rho_0 \nabla \hat{\mu}_{ch}(c) = \varphi''_{ch}(c)\nabla c$$

scalar valued function

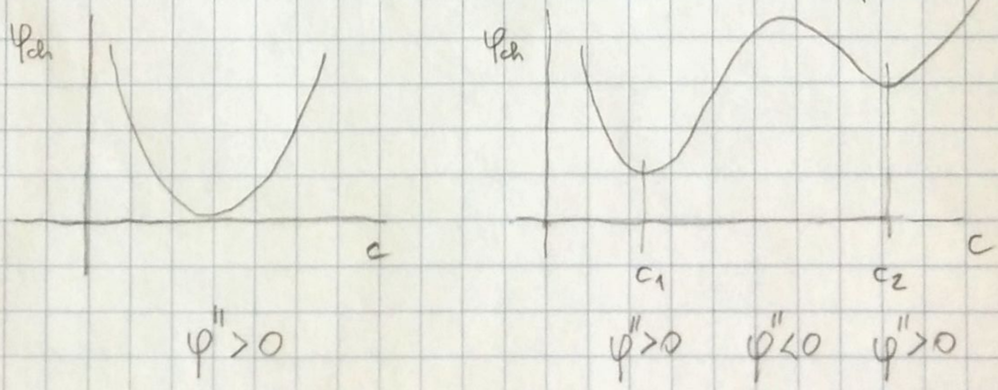
$$\nabla f(\gamma(x))\, e = \lim_{h\to 0} \frac{1}{h}\left(f(\gamma(x+he)) - f(\gamma(x))\right)$$

scalar field

$$= \lim_{h\to 0} \frac{f(\gamma(x+he)) - f(\gamma(x))}{\gamma(x+he)-\gamma(x)} \cdot \frac{\gamma(x+he)-\gamma(x)}{h}$$

$$= f'(\gamma(x))\,\nabla\gamma(x)\, e = f'\,\nabla\gamma\, e$$

double well potential



$\varphi'' > 0$ $\qquad\qquad$ $\varphi'' > 0 \quad \varphi'' < 0 \quad \varphi'' > 0$

[Notebook page scanned on 2018/10/05]

$$\nabla \mu_0 = \nabla \hat{\mu}_{ch}(c) + \frac{\alpha}{\rho_0} \nabla \left(J_p + \varphi_e(F) \right)$$

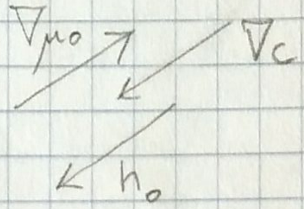
$$\nabla \mu_0 = \frac{1}{\rho_0} \varphi''_{ch}(c) \nabla c + \frac{\alpha}{\rho_0} \nabla \left(J_p + \varphi_e(F) \right)$$

If the second term is negligible then

$$h_0 = -M_0 \nabla \mu_0 = -\frac{1}{\rho_0} \varphi''_{ch}(c) M_0 \nabla c$$

Therefore if $\varphi''_{ch}(c) < 0$ we get

$$h_0 \cdot \nabla c = -\frac{1}{\rho_0} \varphi''_{ch}(c) M_0 \nabla c \cdot \nabla c > 0$$



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