Errata of Soft Matter Physics
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page 26, eq.(2.79)

\[ \mu_i = \mu_i^0(T) + P v_i + k_B T \ln \phi_i + \sum_{j=1}^{n} (2 v_i A_{ij} - \frac{v_i}{v_j}) k_B T \phi_j \]

\[ \rightarrow \]

\[ \mu_i = \mu_i^0(T) + P v_i + k_B T \ln \phi_i + \sum_{j=1}^{n} (2 v_i A_{ij} - \frac{v_i}{v_j}) k_B T \phi_j \]

page 26, problem (2.6)

eq.(2.63) \rightarrow eq.(2.62)

page 27, eq.(2.82)

\[ f(\phi) = \frac{k_B T}{v_c} \left[ \sum_{i=1,2} \frac{1}{N_i} \phi_i \ln \phi_i - \chi(\sum_{i=1,2} \phi_i)^2 \right] \]

\[ \rightarrow \]

\[ f(\phi) = \frac{k_B T}{v_c} \left[ (1 - \phi) \ln(1 - \phi) + \sum_{i=1,2} \frac{1}{N_i} \phi_i \ln \phi_i - \chi(\sum_{i=1,2} \phi_i)^2 \right] \]

page 34

The paragraph after eq.(3.15) must be corrected. The text says "any tensor \( E \) can be written as \( E = Q \cdot L \), where \( L \) is a diagonal tensor, and \( Q \) is an orthogonal tensor." This statement is incorrect. The correct statement is: "any tensor \( E \) can be written as \( E = Q \cdot L \cdot q \), where \( L \) is a diagonal tensor, and \( Q \) and \( q \) are orthogonal tensors." This correction is needed since from eq.(3.17) one cannot conclude that \( E \) is written as \( Q \cdot L \) because eq.(3.17) is satisfied by any tensor having a form of \( Q \cdot L \cdot q \) where \( q \) is an orthogonal tensor. For given \( E \), \( Q \) and \( L \) are determined by diagonalizing \( E \cdot E^t \), and \( q \) is given by

\[ q = (Q \cdot L)^{-1} \cdot E = L^{-1} Q^t E \]  

(1)

The subsequent statement "any uniform deformation is equivalent to a combination of orthogonal stretching (represented by \( L \)) and rotation(represented by \( Q \))" should be corrected to "any uniform deformation is equivalent to a combination of orthogonal stretching (represented by \( L \)) and rotation(represented by \( Q \) and \( q \))."

As an example, consider shear deformation, for which \( E \) is given by (see eq.(3.51))

\[ (E_{\alpha\beta}) = \begin{pmatrix} 1 & \gamma & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \]  

(2)

For this deformation \( Q \) is given by

\[ (Q_{\alpha\beta}) = \begin{pmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix} \]  

(3)
with
\[
\cos \theta = \frac{1}{\sqrt{1 + \frac{1}{4} \left( \gamma - \sqrt{\gamma^2 + 4} \right)^2}} \tag{4}
\]
\[
\sin \theta = \frac{1}{\sqrt{1 + \frac{1}{4} \left( \gamma + \sqrt{\gamma^2 + 4} \right)^2}} \tag{5}
\]
and the principal value of \( L \) is
\[
\lambda_1 = \sqrt{1 + \frac{1}{2} \gamma (\gamma + \sqrt{\gamma^2 + 4})} \tag{7}
\]
\[
\lambda_2 = \sqrt{1 + \frac{1}{2} \gamma (\gamma - \sqrt{\gamma^2 + 4})} \tag{8}
\]
\[
\lambda_3 = 1 \tag{9}
\]

The author thanks Dr. Konstantin Volokh and Dr. David Pine for pointing out this error.

**page 37, margin note**

4\(\pi b^2 \sinh \xi \rightarrow 4\pi b^2 \sin \xi / \xi \)

**page 74,**

The text says "This axis is called the director, and is specified by a unit vector \( \mathbf{n} \)". Definition of \( \mathbf{n} \) is given later, around eq.(5.7): \( \mathbf{n} \) is defined as the unit vector along the principal axis of the tensor order parameter \( Q \) which is defined by eq.(5.6).

**page 49, problem (3.4)**

\[ \lambda_1 = 1 \rightarrow \lambda_3 = 1 \]

**page 50, problem (3.7)**

Add the following sentence at the end of the problem.
"Assume that the polymer in the solution cannot get into the gel."

**page 81, 4th line above the bottom**

while in the state of \( -S < 0 \cdot \iota \) while in the state \( S < 0 \)

**page 92, eq.(5.71)**

\[
F[\psi] = N \left[ k_B T \int du \, \psi(u) \ln \psi(u) + \frac{U}{2} \int du \int du' \, (\mathbf{u} \cdot \mathbf{u'}) \psi(u) \psi(u') \right]
\]

\[
\rightarrow F[\psi] = N \left[ k_B T \int du \, \psi(u) \ln \psi(u) - \frac{U}{2} \int du \int du' \, (\mathbf{u} \cdot \mathbf{u'}) \psi(u) \psi(u') \right]
\]

**page 92, eq.(5.74)**

\[
\frac{k_B T}{U} x = \coth x
\]

\[
\rightarrow \frac{k_B T}{U} x = \coth x - \frac{1}{x}
\]
page 92, eq.(5.79)

\[ S(P) = -\frac{3}{2} k_B P^2 \quad \text{(10)} \]

\[ \rightarrow \]

\[ S(P) = \text{const} - \frac{3}{2} k_B P^2 \quad \text{(11)} \]

page 98, eq.(6.22)

Equation (6.22) can be obtained as follows. Eq.(6.19) is a non-homogeneous linear equation. We can solve it by the method of "undetermined coefficient". First we solve the equation with the non-homogeneous term removed:

\[ m \frac{dv}{dt} = -\zeta v \quad \text{(12)} \]

The solution of this equation is

\[ v(t) = ae^{-t/\tau_v} \quad \text{(13)} \]

where \( a \) is a constant. We then find the solution of the original equation assuming that \( a \) is a function of time. This assumption gives

\[ m \left[ -\frac{a}{\tau_v} + \frac{da}{dt} \right] e^{-t/\tau_v} = -\zeta ae^{-t/\tau_v} + F_r(t) \quad \text{(14)} \]

Then

\[ \frac{da}{dt} = \frac{1}{m} F_r(t)e^{t/\tau_v} \quad \text{(15)} \]

The equation is solved as

\[ a(t) = a(t_0) + \frac{1}{m} \int_{t_0}^t dt_1 F_r(t_1)e^{t_1/\tau_v} \quad \text{(16)} \]

Hence

\[ v(t) = v(t_0)e^{-(t-t_0)/\tau_v} + \frac{1}{m} \int_{t_0}^t dt_1 F_r(t_1)e^{-(t-t_1)/\tau_v} \quad \text{(17)} \]

Setting \( t_0 \) equal to \(-\infty\), we have eq.(6.21).

page 102, eq.(6.45)

\[ x_0 = \int_{-\infty}^t dt_1 e^{-(t-t_1)/\tau_v} v_r(t_1) \quad \text{(18)} \]

\[ \rightarrow \]

\[ x_0 = \int_{-\infty}^t dt_1 e^{t_1/\tau_v} v_r(t_1) \quad \text{(19)} \]

page 111, eq.(6.85)

\[ \zeta_{\alpha\beta} \frac{dx_\beta}{dt} + F_{r\alpha} = 0 \]

\[ \rightarrow \]

\[ -\zeta_{\alpha\beta} \frac{dx_\beta}{dt} + F_{r\alpha} = 0 \]

page 113, eq.(6.105)

\[ G(n, m, t) = \frac{1}{\sqrt{2\pi \lambda}} \exp \left[ -\frac{(n-m)^2}{2\lambda} \right] \]

\[ \rightarrow \]

\[ G(n, m, t) = \frac{1}{\sqrt{4\pi \lambda}} \exp \left[ -\frac{(n-m)^2}{4\lambda} \right] \]
\begin{align*}
\frac{\partial \psi}{\partial t} &= D_r \mathcal{R} \cdot \left( \mathcal{R} \psi + \frac{\mu_r \mathbf{u} \times \mathbf{H}}{k_B T} \psi \right) \\
\rightarrow
\frac{\partial \psi}{\partial t} &= D_r \mathcal{R} \cdot \left( \mathcal{R} \psi - \frac{\mu_r \mathbf{u} \times \mathbf{H}}{k_B T} \psi \right)
\end{align*}

\begin{align*}
\Phi = \frac{\eta}{4} \hbar \int_0^a \, dr \, 2\pi r \left( \frac{dv}{dr} \right)^2 \\
\rightarrow
\Phi = \frac{\eta}{2} \hbar \int_0^a \, dr \, 2\pi r \left( \frac{dv}{dr} \right)^2
\end{align*}

\begin{align*}
\mu(x, x') &= -\frac{\partial}{\partial x} \left[ \frac{n(x)}{\zeta} \frac{\partial}{\partial x'} \delta(x - x') \right] \\
\rightarrow
\mu(x, x') &= -\frac{\partial}{\partial x} \left[ \frac{n(x)}{\zeta} \frac{\partial}{\partial x} \delta(x - x') \right]
\end{align*}

\begin{align*}
\chi(r, r', t) &= \frac{\bar{n}}{k_B T} \left[ g_{md}(r - r', 0) - g_{md}(r - r', t) \right] \\
\rightarrow
\chi(r, r', t) &= \frac{\bar{n}}{k_B T} \left[ g_d(r - r', 0) - g_d(r - r', t) \right]
\end{align*}

\begin{align*}
\frac{\partial \delta \phi}{\partial t} &= \frac{\phi_c}{\zeta} \nabla^2 \left[ a(T - T_c) \delta \phi + \phi_c \kappa_s \nabla^2 \delta \phi - h(r) \right] \\
\rightarrow
\frac{\partial \delta \phi}{\partial t} &= \frac{\phi_c}{\zeta} \nabla^2 \left[ a(T - T_c) \delta \phi - \kappa_s \nabla^2 \delta \phi - h(r) \right]
\end{align*}

\begin{align*}
S_d(k, t) &= \frac{k_B T}{a(T - T_c) + \frac{\phi_c \kappa_s}{\phi_c} k^2} \exp[-\alpha k t] \\
\rightarrow
S_d(k, t) &= \frac{k_B T}{a(T - T_c) + \kappa_s k^2} \exp[-\alpha k t]
\end{align*}
page 164, eq.(8.143)
\[ \alpha_k = \frac{\phi_c k^2}{\xi} \left[ a(T - T_e) + \phi_c \kappa_s k^2 \right] \]
\[ \rightarrow \]
\[ \alpha_k = \frac{\phi_c^2 k^2}{\xi} \left[ a(T - T_e) + \kappa_s k^2 \right] \]

page 164, eq.(8.145)
\[ A = \int_{0}^{h} dx \frac{K_e}{2} \left( \frac{\partial u}{\partial x} \right)^2 - [u(h) - u(0)]w \]
\[ \rightarrow \]
\[ A = \int_{0}^{h} dx \frac{K_e}{2} \left( \frac{\partial u}{\partial x} \right)^2 + [u(h) - u(0)]w \]

page 164, eq.(8.146)
\[ \Phi = \frac{1}{2} \int_{0}^{h} dx \frac{\dot{u}^2}{2\kappa} \]
\[ \rightarrow \]
\[ \Phi = \frac{1}{2} \int_{0}^{h} dx \frac{\dot{u}^2}{\kappa} \]

page 196, problem (9.7)
\( d = 1\, nm \) in water \( \rightarrow \) \( d = 5\, nm \) in water

page 199, 3 lines below eq.(10.8)
Delete the following last sentence of the paragraph "The pK of acid is less than 7 and the pK of base is larger than 7."

This is completely my mistake. I may add the following in the text.
The dissociation of base \( \text{BOH} \)
\[ \text{BOH} \leftrightarrow \text{B}^+ + \text{OH}^- \] (20)
is described by
\[ \log_{10} \frac{1 - \alpha}{\alpha} = \text{pK}_{\text{BOH}} - \text{pOH} = \text{pK}_{\text{BOH}} - 14 + \text{pH} \] (21)

page 221, problem (10.1)
pK=9.3 for \( \text{NH}_4\text{OH} \) \( \rightarrow \) pK=4.7 for \( \text{NH}_4\text{OH} \)

page 221, problem (10.4)
by eq.(10.30) \( \rightarrow \) by eq.(10.27)

page 235, line 2
(see eq.(5.11)) \( \rightarrow \) (see eqs.(5.11) and (5.23))

page 246, Fig.E.1
The label of the y-axis: \( \langle F_j(t) \rangle_{x+\delta x} \rightarrow \langle F_i(t) \rangle_{x+\delta x} \)