Errata
Geophysical Theory
by
W. Menke & D. Abbott
Columbia University Press, 1990

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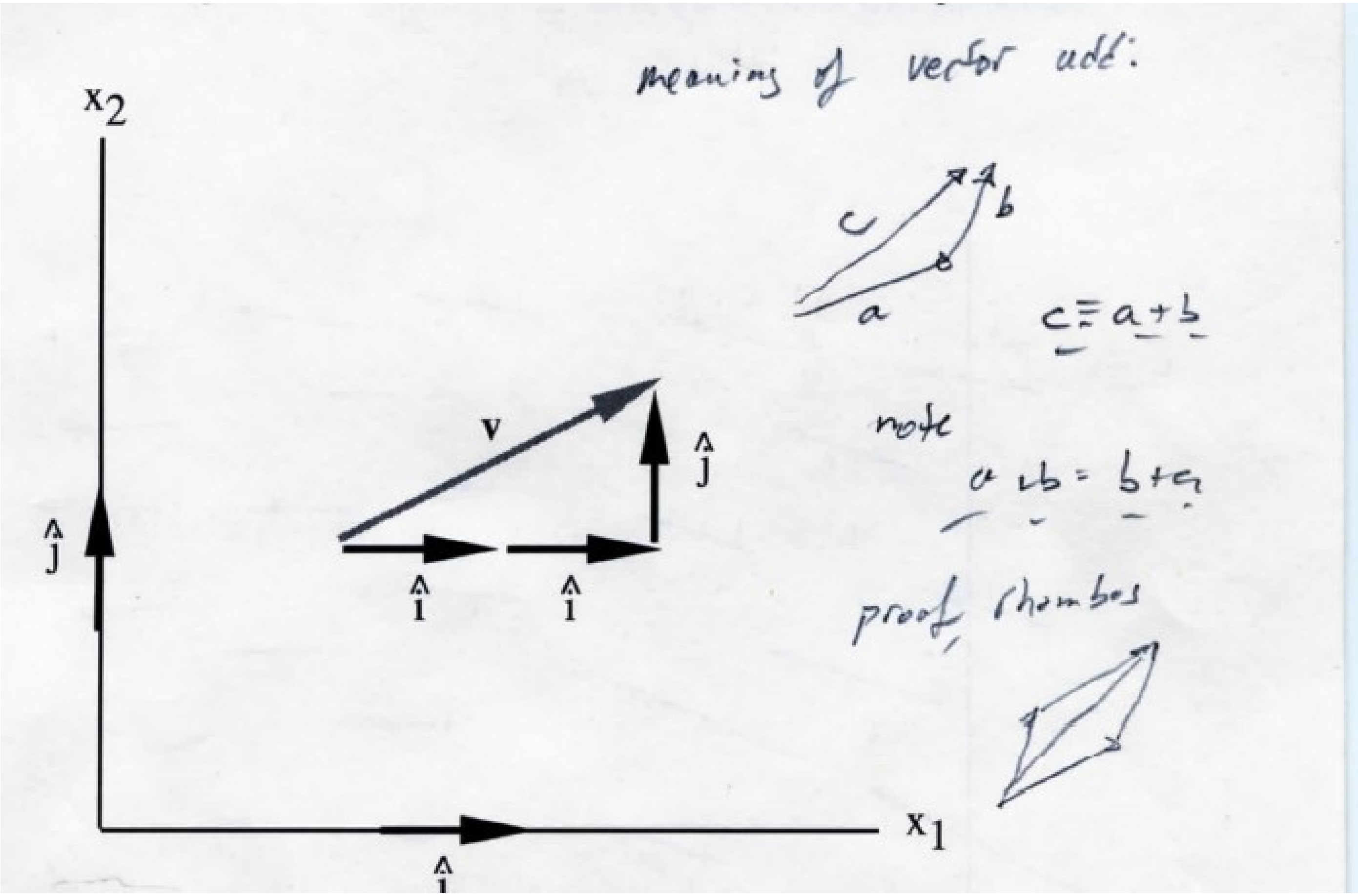
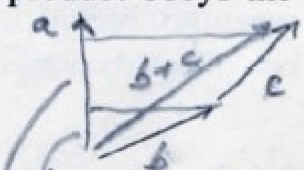
Pg. 19, Insertion



Pg. 21, Insertion

where θ is the angle between the two vectors. The dot product obeys the relationships:

proof:



$$\mathbf{a}\cdot(\mathbf{b}+\mathbf{c}) = \mathbf{a}\cdot\mathbf{b} + \mathbf{a}\cdot\mathbf{c}$$

$$\mathbf{a}\cdot\mathbf{b} = \mathbf{b}\cdot\mathbf{a} \tag{2.6.3}$$

$|b| \cos\theta_{ab} = \underline{a}\cdot\underline{b} / |\underline{a}|$

$|c| \cos\theta_{ac} = \underline{a}\cdot\underline{c} / |\underline{a}|$

Note that the squared length of a vector equals the vector dotted with itself

Pg. 23, Insertion

$$\mathbf{a} \times (\mathbf{b} + \mathbf{c}) = \mathbf{a} \times \mathbf{b} + \mathbf{a} \times \mathbf{c} \quad ①$$

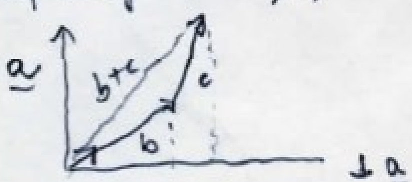
$$\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = (\mathbf{a} \cdot \mathbf{c})\mathbf{b} - (\mathbf{a} \cdot \mathbf{b})\mathbf{c}$$

$$(\mathbf{a} \times \mathbf{b}) \times \mathbf{c} \neq \mathbf{a} \times (\mathbf{b} \times \mathbf{c}) \tag{2.6.10}$$

2.6.4 Tangent Vector to a Curve

A curve in three dimensional space can be described by a position vector, $\mathbf{x}$, that is a function of a single parameter. This parameter is usually the arc-length, s, along the curve from some arbitrary starting point, so that $\mathbf{x} = \mathbf{x}(s)$. The unit tangent, $\hat{t}$, can be constructed by considering the vector connecting two neighboring points on the curve, s and s + Δs (figure 2.6), and then taking the limit as these points approach each other:

① proof easy if a, b, c coplanar

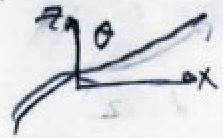


$$|b| \sin\theta_{ab} + |c| \sin\theta_{ac} = |b+c| \sin\theta_{a(b+c)}$$

Pg. 25, Insertion

$$\hat{t} = \lim_{\Delta s \to 0} \frac{\mathbf{x}(s+\Delta s) - \mathbf{x}(s)}{\Delta s} \approx \lim_{\Delta s \to 0} \frac{1}{\Delta s}\begin{bmatrix} \frac{dx}{ds}\Delta s \\ \frac{dy}{ds}\Delta s \\ \frac{dz}{ds}\Delta s \end{bmatrix} = \begin{bmatrix} \frac{dx}{ds} \\ \frac{dy}{ds} \\ \frac{dz}{ds} \end{bmatrix} = \frac{d\mathbf{x}}{ds} \tag{2.6.13}$$

proof $|\hat{t}| = 1$



$x = s \sin\theta$

$z = s \cos\theta$

$\frac{dx}{ds} = \begin{matrix} \sin\theta \\ \cos\theta \end{matrix}$ $\quad \left|\frac{dx}{ds}\right| = \sin^2\theta + \cos^2\theta = 1$

Pg. 38, Missing subscript

$$a(x)\,\frac{d^2}{dx^2}\,y(x) + b(x)\,\frac{d}{dx}\,y(x) + c(x)\,y(x) = e(x) \qquad (2.8.1)$$

Pg. 38, Missing subscript and sign error

$$\frac{d^2}{dx^2} y(x) + c^2 y(x) = 0 \tag{2.8.4}$$

Pg. 39, Missing subscript and sign error

$$\frac{d^2}{dx^2} y(x) + c^2 y(x) = 0 \tag{2.8.6}$$

Pg. 66, Superscript should be subscript, subscript should be superscript

check

We note that the basis vectors $\mathbf{e}'^{i}$ are just the columns of $\mathbf{T}^{-1}$ and the basis vectors $\mathbf{e}'_{i}$ are just the rows of $\mathbf{T}$ (compare equations 3.4.4, 3.4.5, 3.4.7, and 3.4.8), so that:

Pg. 75, Delete prime

$$g'_{ij} = \frac{\partial x^k}{\partial x'^i} \frac{\partial x^l}{\partial x'^j} g'_{kl} \quad \text{or} \quad \mathbf{g}' = \mathbf{T}^{-1T} \mathbf{g}\ \mathbf{T}^{-1} \tag{3.7.11}$$

Pg. 93, Subscript should be superscript

$$\overline{v}_i = h_i\, v_i = h_i^{-1}\, v_{\cancel{i}}^{\,i} \qquad \text{sup.} \tag{3.14.3}$$

Pg. 105, Subscript p should be superscript q

(4.1.34)

The moment of inertia is:

$$M_{pq} = \left[\delta_{rs}\,\delta_{pq} - \delta_{rp}\,\delta_{sq}\right]\left[M x_r^{cm}\, x_s^{cm} + \sum_{i=1}^{N} m^{(i)}\; x'^{(i)}_r\; x'^{(i)}_s\right]$$

$$= M\left[x_k^{cm}\, x_k^{cm}\,\delta_{pq} - x_p^{cm}\, x_q^{cm}\right] + \sum_{i=1}^{N} m^{(i)}\left[x'^{(i)}_k\, x'^{(i)}_k\,\delta_{pq} - x'^{(i)}_p\, x'^{(i)}_p\right]$$

Pg. 113, Primes missing in two places

$$\mathbf{t}' = \mathbf{M}' \, [\dot{\vec{\omega}}' + \dot{s}\hat{k}'] + \vec{\omega}' \times \mathbf{M}' \, [\vec{\omega}' + s\hat{k}'] \tag{4.3.1}$$

Pg. 119, Sign error in two places

$$A\,\dot{\omega}_2' \underset{+}{\cancel{-}} A\,\omega_1'\,\omega_3' \underset{-}{\cancel{+}} C\,\Omega\,\omega_1' = \frac{3\,\gamma\,(C-A)\,M_{sun}}{2r^3}\sin\theta\,\sin 2(pt-\psi) \qquad ? \tag{4.3.22}$$

Pg. 120, Sign error

1.

$$\omega'_x = \dot{\theta} = \frac{+3\,\gamma\, M_{sun}}{2\, r^3\, \Omega}\left[\frac{C-A}{C}\right] \sin\theta \sin 2(pt - \psi) \tag{4.3.23}$$

Pg. 122, Wrong equation referenced

in equation 4.4.5.

We now rewrite equation 4.~~2~~4.5, replacing all derivatives of the rotation matrix with terms involving the angular velocity matrix, **W.** We note that:

Pg. 125, Section misnumbered

4.2.2 Magnitude of the Centrifugal and Coriolis Force at the Surface of the Earth

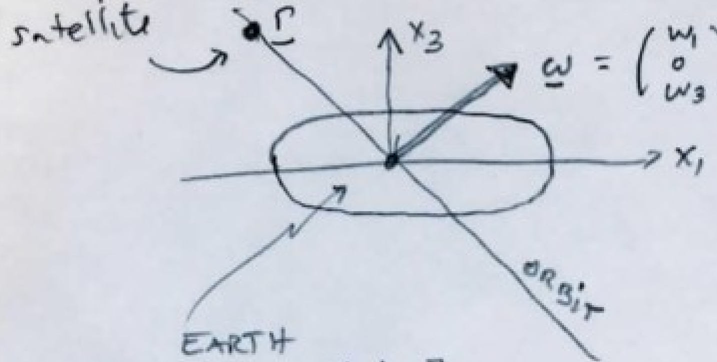
Pg. 130, Insertion in equation

$$\oint_C \mathbf{f}(\mathbf{x}) \bullet \hat{t}\, ds = \int_{C_1} \mathbf{f}(\mathbf{x}) \bullet \hat{t}\, ds - \int_{C_2} \mathbf{f}(\mathbf{x}) \bullet \hat{t}\, ds = \iint_A \nabla \times \mathbf{f} \bullet \hat{n}\, dA = 0$$

$$\int_{C_1} \mathbf{f}(\mathbf{x}) \bullet \hat{t}\, ds = \int_{C_2} \mathbf{f}(\mathbf{x}) \bullet \hat{t}\, ds \tag{5.2.2}$$

After page 125, I had thought about adding a Section on the precession of a satellite, and had prepared these notes:

Precession of satellite "Regression of The nodes"



$\underline{\omega} = \begin{pmatrix} \omega_1 \\ 0 \\ \omega_3 \end{pmatrix}$ of satellite

$M = \mathrm{diag}[A, A, C]$

$$\underline{t} \propto (\underline{\underline{M}} \cdot \underline{r}) \times \underline{r} = \begin{bmatrix} (A-C)\, r_2 r_3 \\ (C-A)\, r_1 r_3 \\ 0 \end{bmatrix}$$ see 4.3.16

$\underline{r} \perp \underline{\omega}$

Newton's Law $$\underline{T} = \frac{d}{dt}\underline{j} = \frac{d}{dt}\left(\underline{r} \times (\underline{\omega} \times \underline{r})\right) = \frac{d}{dt}\left[r^2 \underline{\omega} - \cancelto{0}{(\underline{r} \cdot \underline{\omega})}\,\underline{r}\right]$$

$$\approx r^2 \dot{\underline{\omega}}$$ (for circular orbit r^2=const)

$$\dot{\underline{\omega}} \propto \begin{bmatrix} (A-C)\, r_2 r_3 \\ (C-A)\, r_1 r_3 \\ 0 \end{bmatrix}$$

no change in spin rate

note $\underline{\omega} \cdot \dot{\underline{\omega}} \propto (A-C) r_2 r_3 \omega_2$ $\quad \langle \underline{\omega} \cdot \dot{\underline{\omega}} \rangle = 0$ since

$\mathrm{sgn}(r_2 r_3)$ oscillates around zero with time

but $\dot{\omega}_2 \propto (C-A) r_1 r_3$ $\quad \langle \dot{\omega}_2 \rangle \neq 0$ since

$\mathrm{sgn}(r_1 r_3) \lesssim 0$ always. $\dot{\omega}_2$ = precession rate

note: Precession of equinox or chandler wobble

measure $\frac{C-A}{C}$

satellite precession $C-A$

divide to get C.

The final point is quite important, namely that moment of inertia, C, of the earth can be inferred by combining measurements of satellite precession and precession of the equinoxes (or, alternatively, satellite precession and the Chandler wobble).

Pg. 152, Greater than symbol should be less than symbol

Legendre functions. When m=0, they return the Legendre polynomials: $P_n^0 \propto P_n$ and $Q_n^0 \propto Q_n$. Since P_n is a polynomial of degree n, $d^{|m|}P_n/d\zeta^{|m|}$ is a polynomial of degree n−|m|, which is to say that it is zero if $n-|m|>0$. Only some integral values of m are valid solutions of the Associated Legendre equation, those with $|m| \leq n$. Furthermore $(1-\zeta^2)^{m/2} = \sin^m\theta$, so that

check

Pg. 154, Misspelled word

(5.8.34)

This formula is sometimes more convenient tha~~t~~n equations 5.8.26 and 5.8.27.

Pg. 156, Errors in subscripts in four places

where A_i, B_i and C_i are abbreviations for the more complicated expressions involving a, b, and Δx. Equation 5.9.5 cannot be applied to the points at the ends of the interval, x_1 and x_N, since the quantities $y_{\overset{0}{\cancel{-1}}}$ and y_{N+1} are undefined. Fortunately, the boundary conditions themselves can be used instead of the differential equation at these points. The differential equation 5.9.1 becomes a matrix equation. For instance, with the simple

1, 0
(one 340)

Pg. 158, Misspelled word

Legendre Polynomials, $P_n^m(\cos\theta)$, which are defined on the interval, [a,b] = [0,π]. We first note that the derivative of P_n^m iz zero at the endpoints, since:

is

Pg. 177, Missing equal sign

$$\Phi_{in}(r{=}R,\theta) = \Phi_{out}(r{=}R,\theta) = -\frac{\gamma M}{R} + \sum_{n=1}^{\infty} b_n P_n(\cos\theta) = -\frac{\gamma M}{R} + \sum_{n=1}^{\infty} a_n P_n(\cos\theta) \tag{5.16.7}$$

Pg. 190, Sign error

$$\Phi(k_x,k_y,z) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \Phi(k_x,k_y,k_z)\, e^{ik_z z}\, dk_z = -2\gamma\sigma(k_x,k_y)\int_{-\infty}^{\infty} \frac{\exp[-ik_z(z-z_0)]}{\left(k_x^2+k_y^2\right)+k_z^2}\, dk_z$$

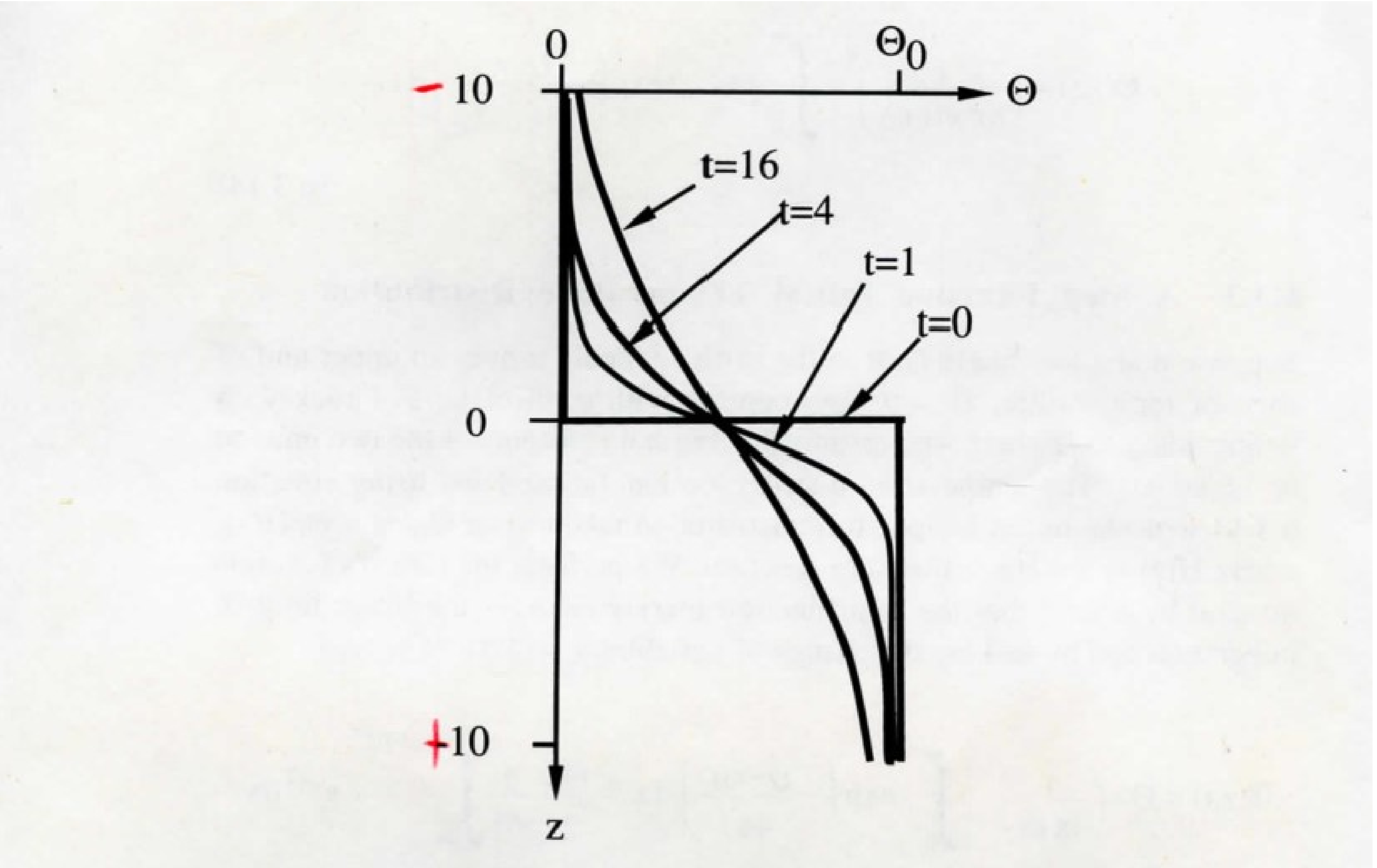
Pg. 201, Delete subscript in two places

$$\Delta f_z^{comp}(x,h) = -2\gamma \left\{ (\rho_2-\rho_1)b(x_{\cancel{0}}) * \frac{h}{h^2+x^2} + (\rho_3-\rho_2)b'(x_{\cancel{0}}) * \frac{(h+T)}{(h+T)^2+x^2} \right\} \tag{5.24.6}$$

Pg. 228, Incorrect equation references in two places

Note that the integral was integrated previously in equation 6.3.5. The similarity between the temperature distribution for a delta function heat
6.3.4 source (equation ~~6.3.13~~) and the temperature distribution for a delta function
6.3.13 initial temperature distribution (equation ~~6.2.4~~) is no coincidence. The first instant after the heat source $\delta(z)\delta(t)$ is applied the temperature rises to

Pg. 230, Sign error on vertical axis of figure in two places



Pg. 232, Delete extra word

6.3.4 Kelvin's (Erroneous) Estimate of the Age of the Earth

The expression for the cooling of of a homogeneous halfspace (equation 6.3.19) is of some historical interest, because it was used by the British

Pg. 233, Replace y with x

also assume that the lithosphere is a halfspace, whose top surface is kept at $\Theta = 0$, with the plane $\cancel{y}$ $x = 0$ (the spreading center) held at $\Theta = \Theta_r$. The relevant form of the heat transport equation is then: x

Pg. 233, Replace x with z in two places

$$c_n = \int_0^h \left\{(\Theta_r - \Theta_o) - (\Theta_a - \Theta_o)\frac{z}{h}\right\} \left(\frac{2}{h}\right)^{1/2} \sin\left(\frac{n\pi \overset{z}{\cancel{x}}}{h}\right) d\overset{z}{\cancel{x}}$$

Pg. 252, Missing ∇ symbol

derivative in Equation 7.6.3 must be interpreted as a material derivative ∇ (Equation 7.21), and the the heat production term becomes $H = -\beta\theta(\dot{\varepsilon}_{ii} + \mathbf{v} \cdot \varepsilon_{ii}) = 3\alpha\theta(\dot{p} + \mathbf{v} \cdot \nabla p)$. Here we have used the relations $(3\lambda + 2\mu)\, \varepsilon_{ii} = \tau_{ii}$ and $p =$

Should read
$+ v \bullet \nabla\varepsilon_{ii}$

Pg. 260, Insert factor of $(2\pi)^3$

$$p(\mathbf{k},\omega) = \frac{\overset{(2\pi)^3}{\cancel{1}}}{c}\, f\left(-\frac{\omega}{c}\right)\delta(\mathbf{k}-\mathbf{k}_0) \tag{8.2.15}$$

Pg. 262, Insert the following sentence at the start of the paragraph after Eqn. 8.3.8:

if $\text{real}(\gamma)<0$ wave grows with z

$$(8.3.8)$$

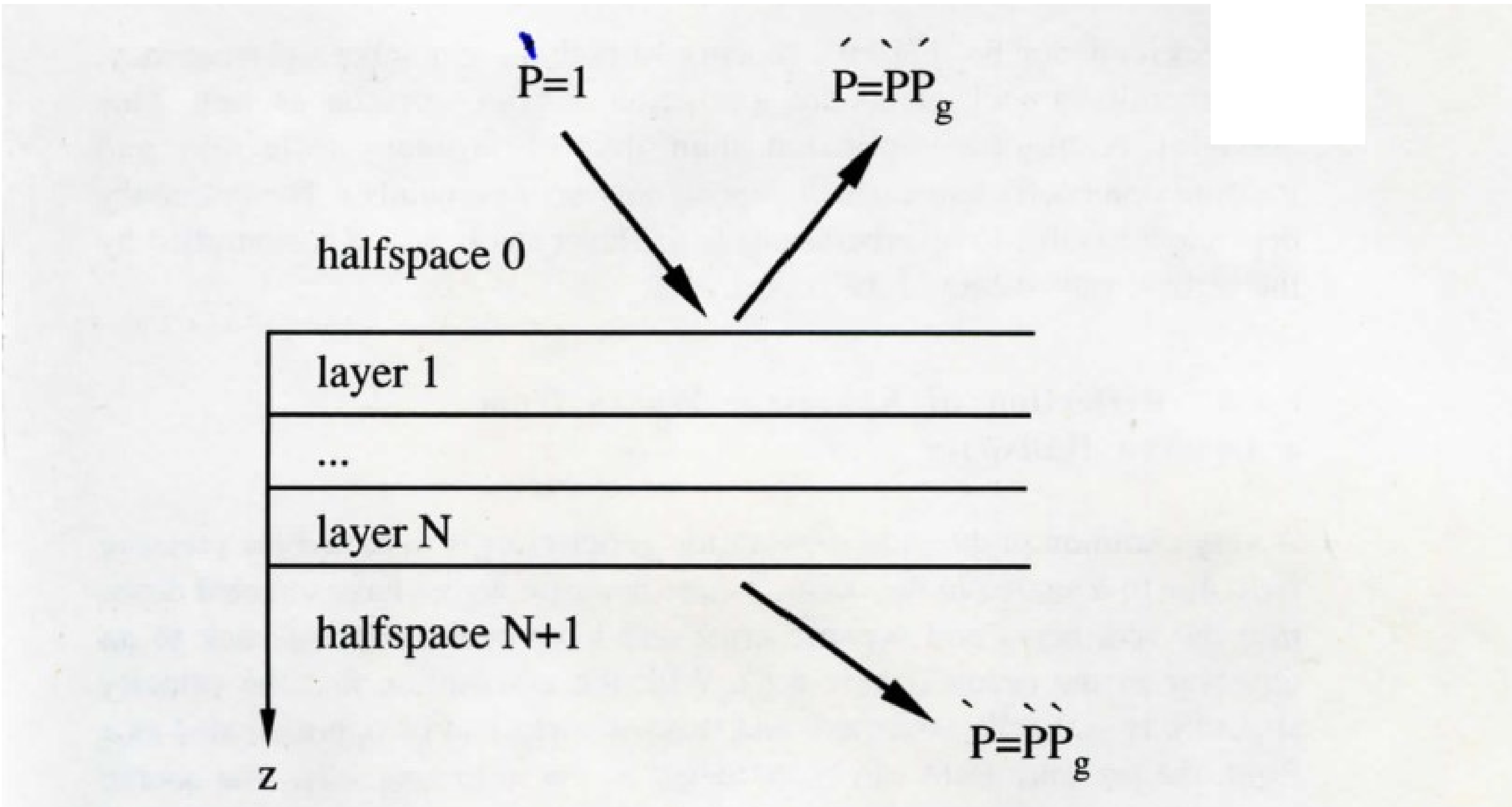
Note that $\gamma=-ik_z$ and $k_z=+i\gamma$.

The exponentially decaying or growing waves are often called *evanescent* or

Pg. 269, Sign errors in four places

$$\frac{\rho_i}{2\gamma_i}\begin{bmatrix} 1 & 1 \\ -\gamma_i/\rho_i & \gamma_i/\rho_i \end{bmatrix}\begin{bmatrix} e^{-\gamma_i z_{i+1}} & 0 \\ 0 & e^{+\gamma_i z_{i+1}} \end{bmatrix}\begin{bmatrix} e^{+\gamma_i z_i} & 0 \\ 0 & e^{-\gamma_i z_i} \end{bmatrix}\begin{bmatrix} \gamma_i/\rho_i & -1 \\ \gamma_i/\rho_i & +1 \end{bmatrix}$$

Pg. 277, Missing grave accent on the P at the top left of the figure



Pg. 269, Sign errors in four places

$$\frac{\rho_i}{2\gamma_i}\begin{bmatrix} 1 & 1 \\ -\gamma_i/\rho_i & \gamma_i/\rho_i \end{bmatrix}\begin{bmatrix} e^{-\gamma_i z_{i+1}} & 0 \\ 0 & e^{+\gamma_i z_{i+1}} \end{bmatrix}\begin{bmatrix} e^{+\gamma_i z_i} & 0 \\ 0 & e^{-\gamma_i z_i} \end{bmatrix}\begin{bmatrix} \gamma_i/\rho_i & -1 \\ \gamma_i/\rho_i & +1 \end{bmatrix}$$

Pg. 370, Replace r with g in equation 10.4.7

g wtr

$$D\int_{x_0-\epsilon}^{x_0+\epsilon} \frac{d^4}{dx^4} w(x)\,dx + g\Delta\rho \int_{x_0-\epsilon}^{x_0+\epsilon} w(x)\,dx = \int_{x_0-\epsilon}^{x_0+\epsilon} \delta(x-x_0)\,dx \qquad (10.4.17)$$

Pg. 374, issue with use of "topography"

currently reads

topography, b(x), and the mean height of the plate, w(x) (figure 10.8):

replace with

bathymetry, $b(x)$ (measured positive downward)

The issue is that the coordinate system is positive-down, so we should be using a quantity that increases with depth.

$$f(x) = g\,(\rho_2 - \rho_1)\,[b(x) - w(x)] \tag{10.4.26}$$

Pg. 374, Eqn 10.4.26, insert minus sign

$$f(x) = - g\,(\rho_2 - \rho_1)\,[b(x) - w(x)] \qquad (10.4.26)$$

There is a mass-excess when flexure is greater than (deeper) than the bathymetry.

Pg. 374, Eqn 10.4.27, has sign and subscript errors

$$D\frac{d^4}{dx^4}w(x) + g(\rho_3 - \rho_1)\,w(x) = \overset{-}{\wedge}\,g(\rho_{\cancel{3}} - \rho_{\cancel{2}})\,[b(x) - w(x)] \qquad (10.4.27)$$

$$\phantom{D\frac{d^4}{dx^4}w(x) + g(\rho_3 - \rho_1)\,w(x) = g(\rho}2 \qquad 1$$

So it reads

$$\left\{D\frac{d^4}{dx^4} + g(\rho_3 - \rho_1)\right\}w(x) = -g(\rho_2 - \rho_1)\{b(x) - w(x)\}$$

There is a mass-excess (positive load) when flexure is greater than (deeper) than the bathymetry.

Pg. 375, Eqn 10.4.28, has sign and subscript errors

$$w(k) = \frac{-\,g\,(\overset{2}{\rho_3} - \overset{1}{\rho_2})\, b(k)}{Dk^4 + g\,(\underset{3}{\rho_2} - \underset{2}{\rho_1})} \qquad (10.4.28)$$

So it reads

$$\bar{w}(k_x) = \frac{-g(\rho_2 - \rho_1)\bar{b}(k_x)}{Dk_x^4 + g(\rho_3 - \rho_2)}$$

I note that Eqn 10.4.29 is correct.

Pg. 378, Append the sentence:

The coefficient of internal friction, β, is often close to 0.8, leading to faults whose surface normal makes an angle of about 65° with the direction of maximum compressive stress.

(Note from Fig. 10.10 that $\theta = \frac{1}{2}[180-(90-\tan^{-1}\beta)] \approx 65^\circ$, for $\tan^{-1}0.8 \approx 38^\circ$).

Pg. 392, Add a prime as shown in Equation 11.5.1 (top equation)

$$0 = -\nabla p + \nu' \nabla^2 \mathbf{v} - \rho \nabla \Phi$$

Pg. 392, Replace r-R with R-r in equation 11.5.1 (bottom equation)

$$\nabla^2\Phi = 4\pi\gamma\rho\, H(r-R) \tag{11.5.1}$$

Pg. 392, Replace r'-R' with R'-r' in equation 11.5.2c

$$\nabla^2\Phi' = 3H(r'-R') \qquad (11.5.2a,b,c)$$

Pg. 393, Add a prime as shown

where the ∇ operator is with respect to $\mathbf{r}'$. Only one material constant, the dimensionless number, $\chi = \rho R_0(gR_0)^{1/2}/\nu'$, appears in the equation.

We will assume that the surface of the deformed earth can be represented as

Pg. 393, At the start of the paragraph following equation 11.6.3, add the sentence:

Note that the units of these quantities are: k, J/K-s-m; ρ, kg/m^2, c_p, J/kg-K; κ, m_2/s and ν', kg/s-m. Thus, the l.h.s of equation 11.6.3 has units of $m^2 \times m^3/kg \times s/m^2 \times s/m^2 \times kg/s^2m = 1$, implying that q is dimensionless.

The fundamental equations, written in terms of the new variables, ξ, ζ, τ, θ, **u**, and q, which are all of order unity in size, are:

Pg. 409, The a’s become b’s and the b’s become a’s, as indicated:

12.3.4. If we take the origin to be the center of the earth, and the polar axis to be the earth's rotation axis, then all coefficients, a_{nm}, are zero, since the field must not grow with radius. The coefficient, b_{00}, is also zero, since it is controlled by the total amount of magnetic charge in the earth, which is zero. (We have encountered this behavior previously in connection with gravity in section 5.15, where the n = 0 coefficient of the gravity field was controlled by the total mass.) The magnetic induction decays no slower than r^{-3}. The dominant r^{-3} behavior is controlled by the coefficients $b_{1,-1}$, $b_{1,0}$, and $b_{1,1}$. For the earth, the coefficient, $b_{1,0}$, is the largest, because of the effect of the earth's rotation on fluid motion in the core. The r^{-3} part of the earth's

Pg. 417, Bold H in two places, as indicated:

and magnetic induction are then related by $\langle \mathbf{B} \rangle = \mu_0(1 + \chi_m)H$ or $\langle \mathbf{B} \rangle =$ bold
μH, where $\mu = \mu_0(1 + \chi_m)$ is the magnetic *permeability*. In a *ferro-* bold
magnetic substance, there is a magnetic moment, **M**, even in the absence of

Pg. 420, Insert μ_0 after + sign

The magnetic field is assumed to be related to magnetic induction by $\mathbf{B} = \mu_0\mathbf{H} + \mu_0\mathbf{M}(\mathbf{x})$, where the magnetization, $\mathbf{M}$, is specified, so equation 12.5.1a becomes:

Pg. 420, Delete μ_0^{-1} in two places in equation 12.5.2:

$$\nabla \cdot \mathbf{H} = -\cancel{\mu_0^{-1}}\nabla \cdot \mathbf{M}(\mathbf{x}) \quad \text{or} \quad \nabla^2 \Phi_M = \cancel{\mu_0^{-1}}\nabla \cdot \mathbf{M}(\mathbf{x}) \tag{12.5.2}$$

Pg. 420, Delete μ_0 in in equation 12.5.3:

$$\Phi_M = -\frac{1}{4\pi\cancel{\mu_0}}\iiint_V \frac{\nabla \cdot \mathbf{M}}{|\mathbf{x}-\mathbf{x}_0|}\, dV_{\mathbf{x}_0} \qquad (12.5.3)$$

Pg. 420, Delete μ_0 in in equation 12.5.4a:

$$\Phi_M = \frac{1}{4\pi \cancel{\mu_0}} \iiint_V \mathbf{M}(\mathbf{x}_0) \cdot \nabla\left(\frac{1}{|\mathbf{x} - \mathbf{x}_0|}\right) dV_{\mathbf{x}_0}$$

Pg. 421, Delete μ_0 in in equation 12.5.4 b,c,d:

$$= \frac{1}{4\pi\cancel{\mu_0}} \iiint_V \mathbf{M}(\mathbf{x}_0) \cdot \frac{(\mathbf{x}-\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^3}\, dV_{\mathbf{x}_0}$$

$$= -\frac{1}{4\pi\cancel{\mu_0}} \nabla \cdot \iiint_V \frac{\mathbf{M}(\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|}\, dV_{\mathbf{x}_0}$$

(12.5.4 a,b,c)

$$\mathbf{H} = -\nabla\Phi_M = \frac{1}{4\pi\cancel{\mu_0}} \iiint_V \left(\frac{\mathbf{M}(\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^3} - 3\, \mathbf{M}(\mathbf{x}_0) \cdot (\mathbf{x}-\mathbf{x}_0)\, \frac{(\mathbf{x}-\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^5} \right) dV_{\mathbf{x}_0}$$

(12.5.4 d)

Pg. 421, Delete μ_0 in in equation 12.5.4 b,c,d:

$$= \frac{1}{4\pi\cancel{\mu_0}} \iiint_V \mathbf{M}(\mathbf{x}_0) \bullet \frac{(\mathbf{x}-\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^3}\, dV_{\mathbf{x}_0}$$

$$= -\frac{1}{4\pi\cancel{\mu_0}} \nabla \bullet \iiint_V \frac{\mathbf{M}(\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|}\, dV_{\mathbf{x}_0}$$

(12.5.4 a,b,c)

$$\mathbf{H} = -\nabla\Phi_M = \frac{1}{4\pi\cancel{\mu_0}} \iiint_V \left(\frac{\mathbf{M}(\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^3} - 3\, \mathbf{M}(\mathbf{x}_0) \bullet (\mathbf{x}-\mathbf{x}_0)\, \frac{(\mathbf{x}-\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|^5} \right) dV_{\mathbf{x}_0}$$

(12.5.4 d)

Pg. 421, Delete μ_0 in in equation 12.5.5:

$$\Phi_M = \frac{1}{4\pi\cancel{\mu_0}} \frac{\mathbf{m} \bullet (\mathbf{x}-\mathbf{x}')}{|\mathbf{x}-\mathbf{x}'|^3} \tag{12.5.5}$$

Pg. 421, Delete μ_0 in in equation 12.5.6:

$$\Phi_M = -\frac{1}{4\pi \cancel{\mu_0}} \hat{n} \bullet \nabla \iiint_V \frac{f(\mathbf{x}_0)}{|\mathbf{x}-\mathbf{x}_0|} dV_{\mathbf{x}_0} \tag{12.5.6}$$

Pg. 421, Delete μ_0 in in equation 12.5.7:

$$\Phi_M = \frac{1}{4\pi\gamma\rho_0\cancel{\mu_0}}\hat{n}\bullet\nabla\Phi_G \tag{12.5.7}$$

Pg. 425, Insert μ_0 and μ_s in the left equation in 12.6.2 and delete them in the right

$$\mu_o \frac{\partial \Phi_H^{out}}{\partial r}\bigg|_{r=R} = \mu_s \frac{\partial \Phi_H^{in}}{\partial r}\bigg|_{r=R} \quad \text{and} \quad \cancel{\mu_0} \frac{\partial \Phi_H^{out}}{\partial \theta}\bigg|_{r=R} = \cancel{\mu_s} \frac{\partial \Phi_H^{in}}{\partial \theta}\bigg|_{r=R} \tag{12.6.2}$$

μ_0 μ_s

Pg. 425, Insert the ratio μ_s/μ_0 in the left equation in 12.6.3 and delete it from the right

μ_s/μ_0

$$-H_0 - 2a_1R^{-3} = b_1 \quad \text{and} \quad -H_0R + a_1R^{-2} = \cancel{\mu_s} b_1 R/\cancel{\mu_0} \tag{12.6.3}$$

Pg. 426, The denominator should be $2+\mu_s/\mu_0$ in two placed in equation 12.6.4

$$a_1 = \frac{(1-\mu_s/\mu_0)}{(2+\cancel{2}\mu_s/\mu_0)} H_0 R^3 \qquad b_1 = -H_0\left(\frac{3}{2+\cancel{2}\mu_s/\mu_0}\right) \tag{12.6.4}$$

Pg. 427, Bold E and bold B in equation 12.7.3

$$\underset{\smile}{E} = \mathbf{e}\ \exp\{\ i\mathbf{k}\bullet\mathbf{x} - i\omega t\ \} \quad \text{and} \quad \underset{\smile}{B} = \mathbf{b}\ \exp\{\ i\mathbf{k}\bullet\mathbf{x} - i\omega t\ \} \tag{12.7.3}$$

bold

Pg. 427, Bold E and bold B in equation 12.7.3

$$\underline{E} = \mathbf{e} \exp\{ i\mathbf{k}\bullet\mathbf{x} - i\omega t \} \quad \text{and} \quad \underline{B} = \mathbf{b} \exp\{ i\mathbf{k}\bullet\mathbf{x} - i\omega t \} \tag{12.7.3}$$

bold

Pg. 428, Insert the following text after12.7.5

(Note: to solve $k_r+ik_i = \sqrt{1+ia}$ for a real parameter, a,
write $(k_r+ik_i)^2 = (k_r^2-k_i^2) + i\,2k_r k_i = 1 + ia$,
so $k_r^2 - k_i^2 = 1$ and $2k_r k_i = a$.
This gives a quadratic eqn for k_i^2).

Pg. 430, Change bold D to bold E

E

of incidence; we treat only the normal incidence case here.) The two coefficients, R and T, are determined by the boundary conditions at the surface of the halfspace (z = 0), $[\cancel{\mathbf{D}}] \times \hat{n} = [\mathbf{H}] \times \hat{n} = 0$ (see equations 12.4.19, two of which are satisfied trivially). The first boundary condition gives 1 + R = T. The second gives:

Pg. 436, Replace subscript 0 with subscript 1:

2.6 Suppose that N unit vectors, $\mathbf{v}^{(1)}, \mathbf{v}^{(2)}, \mathbf{v}^{(3)}, \ldots, \mathbf{v}^{(N)}$, point in different directions. What is their *average* direction? Argue that a reasonable definition of an average unit vector, <**v**>, is the one that maximizes the sum
1 of dot products, $\Sigma_{i=\cancel{0}\,1}^{N}<\mathbf{v}>\bullet\mathbf{v}^{(i)}$. Use the method of Lagrange multipliers to find <**v**>. What is the interpretation of the Lagrange multiplier, λ?

Pg. 437, Replace subscript 0 with subscript 1:

3.3 Suppose $\mathbf{v}^{(1)}$, $\mathbf{v}^{(2)}$, $\mathbf{v}^{(3)}$, ... , $\mathbf{v}^{(N)}$, are the mutually orthogonal unit length eigenvectors of a N by N Cartesian tensor, **A**. Show that any vector, **v**, can be written as a sum of these eigenvectors, $\mathbf{v} = \Sigma_{i=\cancel{0}\,1}{}^{N} a_i \mathbf{v}^{(i)}$, where the coefficients are given by $a_i = \mathbf{v} \bullet \mathbf{v}^{(i)}$. The vector, **v**, is said to have been *expanded* in the eigenvectors of **A**. 1

Pg. 439, Argument of exponential should read $-x^2/2\sigma^2$

5.5 Compute the vertical gravity anomaly over an uncompensated mountain of density, ρ, and height $z(x,y) = \exp(-x_2/2\sigma_2)$, where σ is a constant, using the approximation of section 5.24.