Errata

Structural Geology Algorithms

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We've discovered first hand just how hard it is to produce an error free book. This sheet lists the errors that we have found to date and provides correction. Please let Rick Allmendinger (rwa1@cornell.edu) know if you find any additional typos and let Nestor Cardozo (nestor.cardozo@uis.no) know if you identify any problems with the Matlab™ scripts. Thanks!

Chapter 2

- Section 2.3.2, p. 26 — Third sentence in the section should read (changes in red):

  "Vectors in ~~these notes~~ this book are shown in lower case with bold face print (which is sometimes known as symbolic or Gibbs notation):"

- P. 39, Section 2.4.2 — cosα for the second row in the table in step 1 is incorrect:

  ~~0.1.34~~ 0.1034

Chapter 3

- Section 3.4.3, p. 58 — Sentence in the middle of the page should read (changes in red):

  "One of the main reasons for using a right-hand rule format for specifying strike azimuths is that ~~that~~ a vector will automatically trace out a lower hemisphere great circle when rotated 180° clockwise about the pole (a positive rotation). "

Chapter 4

- P. 73, first full sentence after Equation 4.22 — the second set of subscripts of C are incorrect. The correct version follows:

  "But, suppose we have the condition that $C_{ij} = -C_{ji}$."

- P. 74, Equation 4.27 — The minus sign in front of the second term on the right side of the equation should be a plus sign. The correct equation is given below:

$$|\mathbf{M}| = \begin{vmatrix} M_{11} & M_{12} & M_{13} \\ M_{21} & M_{22} & M_{23} \\ M_{31} & M_{32} & M_{33} \end{vmatrix} = M_{11}\mathrm{cof}_{11}(\mathbf{M}) + M_{12}\mathrm{cof}_{12}(\mathbf{M}) + M_{13}\mathrm{cof}_{13}(\mathbf{M})$$

- P. 77, 3rd from last line on the page — the reference to the equations is incorrect. It should read:

  "…*orthogonality relations* (Eqs. ~~3.3 and 3.4~~ 3.4 and 3.5)."

Chapter 5

- P. 88, Equation (5.16) — The T_{22} component of the matrix is incorrect: it should read T_2 and not 1. The correct equation is below:

$$T'_{ij} = \begin{bmatrix} \left(T_1\cos^2\theta + T_3\sin^2\theta\right) & 0 & \left(-T_1\sin\theta\cos\theta + T_3\sin\theta\cos\theta\right) \\ 0 & T_2 & 0 \\ \left(-T_1\sin\theta\cos\theta + T_3\sin\theta\cos\theta\right) & 0 & \left(T_1\sin^2\theta + T_3\cos^2\theta\right) \end{bmatrix}$$

Chapter 6

- P. 116, sentence located between equations 6.31 and 6.32 should read (changes in red):

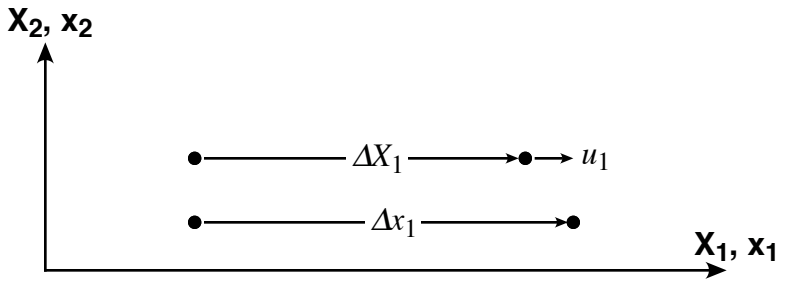
  "By setting the second equation in 6.31 to zero and using the orthogonality relations (equations (~~3.3~~ 3.4) and (~~4.28~~ 3.5)), "

- P. 101, Section 6.2.2, first equation on the page is missing a subscript. The correct version is below:

$$V = \frac{1}{3}A = \frac{1}{3}A_1\left(\overleftrightarrow{OA}\right) = \frac{1}{3}A_2\left(\overleftrightarrow{OB}\right) = \frac{1}{3}A_3\left(\overleftrightarrow{OC}\right)$$

Chapter 8

- P. 136, Figure 8.1 — The lengths of the lines should be preceded by the Greek letter delta (Δ). The corrected figure is below:



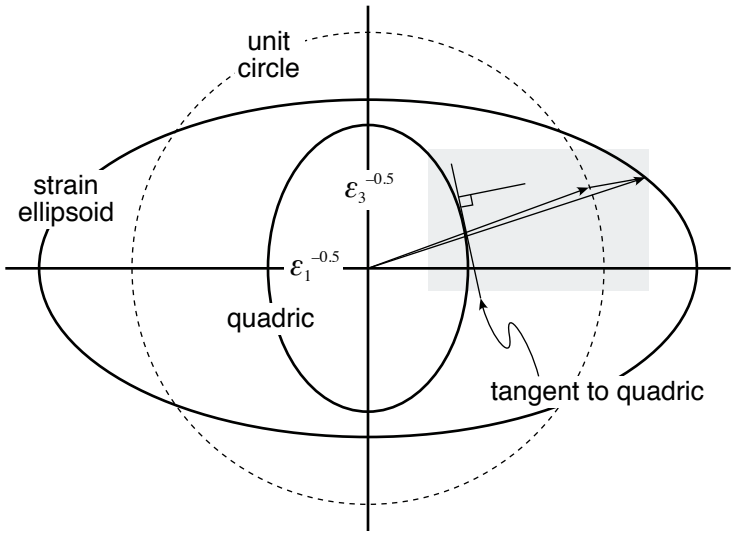
- P. 137, section 8.1.3 — Sentence starting with "Likewise…" has some incorrect subscripts. The correct sentence is below (changes in red):

  "Likewise, e_{12} will be approximately equal to $-\phi$ because it is a rotation of ΔX_2 towards $\mathbf{X_2}$ (counterclockwise), whereas we just saw that e_{12} is a clockwise rotation of ΔX_2 towards $\mathbf{X}_1$."

- P. 139, first sentence of section 8.2.2 should read (changes in red):

  "If the deformation is the same throughout the region, then the displacement~~s~~ gradients are not a function of position."

- P. 142, Figure 8.7 — the axes of Figure 8.7a are mislabeled. The corrected figure is below:



(a)

- P. 144, Equations 8.13 and 8.14 are missing a minus sign. The correct equation is below:

$$\varepsilon'_{ij} = \begin{bmatrix} \varepsilon'_{11} & 0 & \varepsilon'_{13} \\ 0 & \varepsilon_2 & 0 \\ \varepsilon'_{31} & 0 & \varepsilon'_{33} \end{bmatrix} = \begin{bmatrix} \left(\varepsilon_1 \cos^2\theta + \varepsilon_3 \sin^2\theta\right) & 0 & \left(\left(\varepsilon_3 - \varepsilon_1\right)\cos\theta \sin\theta\right) \\ 0 & \varepsilon_2 & 0 \\ \left(-\left(\varepsilon_1 - \varepsilon_3\right)\cos\theta \sin\theta\right) & 0 & \left(\varepsilon_1 \sin^2\theta + \varepsilon_3 \cos^2\theta\right) \end{bmatrix}$$

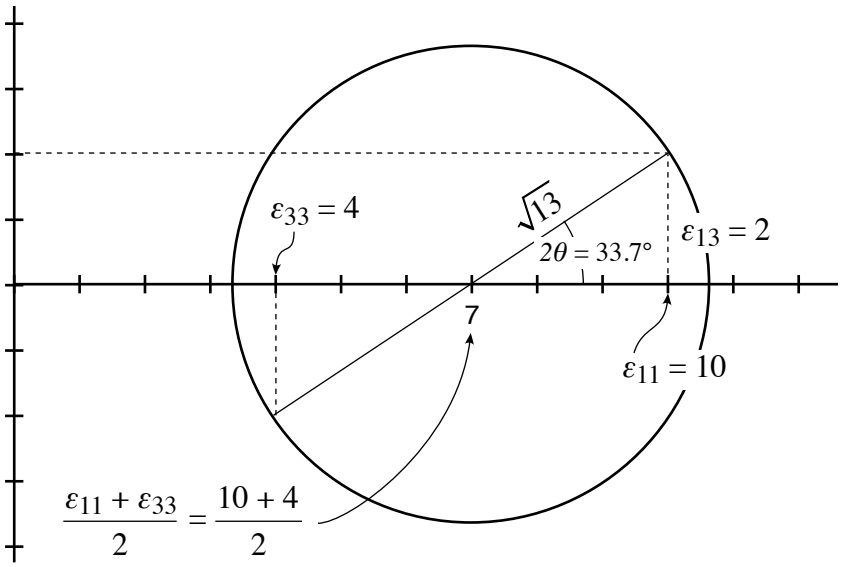
$$\varepsilon'_{11} = \frac{\left(\varepsilon_1 + \varepsilon_3\right)}{2} + \frac{\left(\varepsilon_1 - \varepsilon_3\right)}{2}\cos 2\theta$$

$$\varepsilon'_{13} = \frac{\gamma}{2} = -\frac{\left(\varepsilon_1 - \varepsilon_3\right)}{2}\sin 2\theta$$

- P. 144, second sentence after equation 8.14, the second 45° is missing a minus sign. It should read:

  "Probably the most important thing illustrated by Figure 8.9 is that the two planes of maximum shear strain are oriented at +45° and –45° to the principal axes, ε_1 and ε_3."

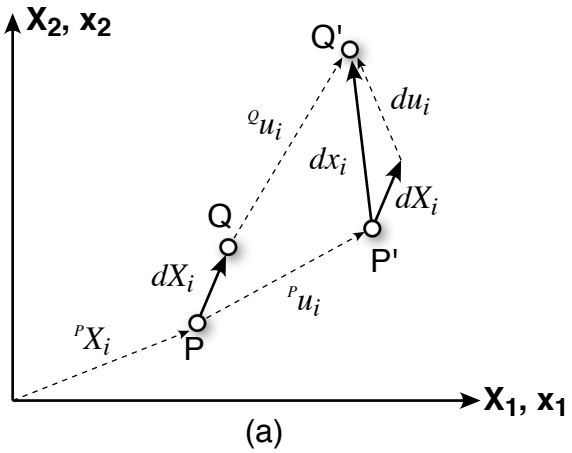
- P. 145, Figure 8.11 is incorrectly labeled. The corrected version is below:



- P. 153, function PTAxes has an error in the calculation of the slip direction. See the appendix at the end of this document for the corrected script.

Chapter 9

- P. 166, Figure 9.1 — the "partial" sign "∂" should be a normal "d". The corrected figure is below:



- P. 167, Section 9.4 — the left side of first equation in this section has an incorrect subscript. The corrected version is below:

$$\left|P'Q'\right|^2 = dx_i dx_i = dx_1^2 + dx_2^2$$

- P. 170, bottom, section 9.7.2 — the last equation on this page is incorrect (the left side should be small "e" rather than capital "E"). The corrected version is below:

$$e_{(1)} = \sqrt{C_{11}} - 1 = \sqrt{1 + 2E_{11}} - 1$$

- P. 171, top, section 9.7.2 — the first equation on this page is incorrect (the right side should be small "e" rather than capital "E"). The corrected version is below:

$$E_{11} = e_{(1)} + \frac{1}{2} e_{(1)}^2$$

- P. 177, first equation on the page, as well as Equation 9.28 are missing a minus sign. The corrected versions are below:

$$\bar{C}'_{ij} = \begin{bmatrix} \bar{C}'_{1X1} & 0 & \bar{C}'_{13} \\ 0 & \bar{C}_2 & 0 \\ \bar{C}'_{31} & 0 & \bar{C}'_{33} \end{bmatrix} = \begin{bmatrix} \left(\bar{C}_1 \cos^2\theta + \bar{C}_3 \sin^2\theta\right) & 0 & \left(\left(\bar{C}_3 - \bar{C}_1\right)\cos\theta \sin\theta\right) \\ 0 & \bar{C}_2 & 0 \\ \left(-\left(\bar{C}_1 - \bar{C}_3\right)\cos\theta \sin\theta\right) & 0 & \left(\bar{C}_1 \sin^2\theta + \bar{C}_3 \cos^2\theta\right) \end{bmatrix}$$

$$\bar{C}'_{13} = -\frac{\left(\bar{C}_1 - \bar{C}_3\right)}{2} \sin 2\theta$$

Chapter 10

- P. 188, last three lines on the page should read:

  "axis orientation is stable for passive line markers rotated or perturbed in a ~~counterclockwise~~ clockwise sense and unstable for markers rotated ~~clockwise~~ counterclockwise, much like a ball at rest on a ledge"

- P. 190, last sentence on page:

  "The internal rotation (ω_i) within the rotation matrix R is equal to ~~8/2~~ $\gamma/2$ for small strains"

- P. 195, sentence preceding equation (10.17):

"…so the deformation gradient matrix for simultaneous pure and simple shearing is:"

- P. 200, sentence preceding equation (10.18):

  "…the internal ~~velocity~~ vorticity ($\~{\omega}_i$ $\dot{\omega}_i$):"

- P. 200, middle of page near end of second paragraph"

  "… equal and opposite in sign to the angular shear associated with ~~flexime~~ flexural shear."

- P. 212, near bottom of page:

```
"%Determine ~~Cauchy~~ Green deformation tensor
for i=1:n-1
      C(:,:,i)=finmat(:,:,i)'*finmat(:,:,i);
      %Stretch magnitude and orientation: Maximum eigenvalue and
      their
      %corresponding eigenvectors of ~~Cauchy's~~ Green's tensor. Use
      Matlab function eig"
```

- P. 213, top of page:

```
ylabel('~~Progressive Finite Strain~~ Maximum finite stretch');
```

Chapter 11

- P. 221, Section 11.4.1 — The first sentence after Equation 11.11 is incorrect. The corrected sentence follows (changes in red):

  "For $\theta = 30°$, $\tan^{-1}(\partial f/\partial x_1)$ or ψ_1 (Fig. 11.2) = ~~125°~~ 105°.

- P. 227, equation (11.15) — "x's" should be in italics. The corrected equation is below:

$$v_2' = \frac{s\left[\cos\alpha\sin\alpha + \left(\frac{\partial f}{\partial x_1}\right)\cos^2\alpha\right] + {}^2v_2 - {}^2v_1\frac{\partial f}{\partial x_1}}{\cos\alpha - \frac{\partial f}{\partial x_1}\sin\alpha}$$

- P. 243, immediately above code snippet at bottom of page:

"To make a contractional, trishear fault propagation fold with initial fault tip (x_1 H = 300, x_2 V = 50), ramp angle = 30°, P/S = 1.5, trishear angle = 60°, fault slip = 100 units, and concentration factor = 1.0, type:"

Chapter 12

- P. 263, in function BalCrossErr — the word "vertices" should be on the same line with the rest of the sentence or should be preceded by a a "%" to indicate that it is a comment:

```
"% kk = A flag to indicate wether the program computes total errors
%     (kk = 0), errors due to stratigraphy only (kk = 1), errors due to
%     vertices at decollement only (kk = 2), errors due to vertices in
%     eroded hanging walls only (kk = 3), errors due to surface
%     vertices
```

Appendix A — Corrected PTAxes Matlab™ Script

```
function [P,T] = PTAxes(fault,slip)
%PTAxes computes the P and T axes from the orientation of several fault
%planes and their slip vectors. Results are plotted in an equal area
%stereonet
%
%   USE: [P,T] = PTAxes(fault,slip)
%
%   fault = nfaults x 2 vector with strikes and dips of faults
%   slip = nfaults x 2 vector with trends and plunges of slip vectors
%   P = nfaults x 2 vector with trends and plunges of the P axes
%   T = nfaults x 2 vector with trends and plunges of the T axes
%
%   NOTE: Input/Output angles are in radians
%         Slip vector should be given such that it points in the direction
%         of fault slip: For example, for a thrust fault with strike and
%         dip (right hand rule) 000/30, and dip slip motion, the trend and
%         plunge of the slip vector should be 90/-30
%
%   PTAxes uses functions SphToCart, CartToSph, Stereonet, GreatCircle and
%   StCoordLine
%
%MATLAB script written by Nestor Cardozo for the book Structural
%Geology Algorithms by Allmendinger, Cardozo, & Fisher, 2011. If you use
%this script, please cite this as "Cardozo in Allmendinger et al. (2011)"

%Initialize some vectors
n = zeros(1,3);
u = zeros(1,3);
eps = zeros(3,3);
P = zeros(size(fault,1),2);
T = zeros(size(fault,1),2);

%For all faults
for i=1:size(fault,1)
    %Assume that slip vector is pointing down
```

```
    up = 'n';
    %If slip vector is pointing up
    if slip(i,2) < 0.0
        slip(i,2) = -slip(i,2);
        up = 'y';
    end
    %Direction cosines of pole to fault and slip vector
    [n(1),n(2),n(3)] = SphToCart(fault(i,1),fault(i,2),1);
    [u(1),u(2),u(3)] = SphToCart(slip(i,1),slip(i,2),0);
    %Compute u(i)*n(j) + u(j)*n(i) (Eq. 8.32)
    for j=1:3
        for k=1:3
            eps(j,k)=u(j)*n(k)+u(k)*n(j);
        end
    end
    %Compute orientations of principal axes of strain. Here we use the
    %MATLAB function eig
    [V,D] = eig(eps);
    %If slip vector is pointing down
    if up == 'n'
        %P orientation
        [P(i,1),P(i,2)] = CartToSph(V(1,3),V(2,3),V(3,3));
        %T orientation
        [T(i,1),T(i,2)] = CartToSph(V(1,1),V(2,1),V(3,1));
    %Else if slip vector is pointing up
    else
        %P orientation
        [P(i,1),P(i,2)] = CartToSph(V(1,1),V(2,1),V(3,1));
        %T orientation
        [T(i,1),T(i,2)] = CartToSph(V(1,3),V(2,3),V(3,3));
    end
end

%Plot stereonet
Stereonet(0,90*pi/180,10*pi/180,1);
hold on;
```

```
%Plot other elements
for i=1:size(fault,1)
    %Plot fault
    [path] = GreatCircle(fault(i,1),fault(i,2),1);
    plot(path(:,1),path(:,2),'r');
    %Plot Slip vector (red square)
    [xp,yp] = StCoordLine(slip(i,1),slip(i,2),1);
    plot(xp,yp,'rs');
    %Plot P axis (black, filled circle)
    [xp,yp] = StCoordLine(P(i,1),P(i,2),1);
    plot(xp,yp,'ko','MarkerFaceColor','k');
    %Plot T axis (black circle)
    [xp,yp] = StCoordLine(T(i,1),T(i,2),1);
    plot(xp,yp,'ko');
end

%Release plot
hold off;

end
```