Errors/Misprints in

An Introduction to Continuum Mechanics by J. N. Reddy
Cambridge University Press, New York, 2008

1. **Page 21**: The 5th expression under SOLUTION should be modified to read as follows:
   5. A valid expression in most branches of mathematics; however, in mechanics such relations may not arise. If they do, they are invalid because they violate the form-invariance under a basis transformation (every component of a vector cannot be the same in all bases).
2. **Page 33**: Eq. (2.4.5), the superscript on *x* should be subscript to be consistent with Figure 2.4.1
$$\mathbf{e}_i \equiv \frac{\partial \mathbf{x}}{\partial q^i} = \frac{\partial x_j}{\partial q^i}\hat{\mathbf{e}}_j, \quad i = 1,2,3. \qquad (2.4.5)$$
3. **Page 34**: Eq. (2.4.12), in the 2nd row, the vectors $\mathbf{e}_j$, $\mathbf{e}^j$ should be A_j and A^j respectively
$$A^i = g^{ij}A_j, \quad A_i = g_{ij}A^j \qquad (2.4.12)$$
4. **Page 45**: Add the word "isotropic" between "fourth-order" and "tensor" to the text just above Eq. (2.5.19) ["… of every fourth-order isotropic tensor **C** can be expressed as"]
5. **Page 67**: 2nd line from the bottom, add "2" to the second expression of the temperature.
6. **Page 69: There is no error here but only an explanation to the readers.**
   Two types of gradients are used in continuum mechanics books: forward and backward gradients. Most readers miss to note the difference unless they are careful to check it operationally. The forward gradient is the usual gradient
$$\vec{\nabla}\mathbf{u} = \hat{\mathbf{e}}_i \frac{\partial}{\partial x_i}\left(\hat{\mathbf{e}}_j u_j\right) = \frac{\partial u_j}{\partial x_i}\hat{\mathbf{e}}_i\hat{\mathbf{e}}_j = u_{j,i}\hat{\mathbf{e}}_i\hat{\mathbf{e}}_j\,.$$
   The backward gradient is
$$\overleftarrow{\nabla}\mathbf{u} = (\vec{\nabla}\mathbf{u})^{\mathrm{T}} = \frac{\partial u_j}{\partial x_i}\left(\hat{\mathbf{e}}_i\hat{\mathbf{e}}_j\right)^{\mathrm{T}} = u_{j,i}\hat{\mathbf{e}}_j\hat{\mathbf{e}}_i = u_{i,j}\hat{\mathbf{e}}_i\hat{\mathbf{e}}_j\,,$$
   which is often used (without explanation) in defining the deformation gradient tensor and velocity gradient tensor.

   In the present book only one gradient operator, namely forward gradient operator (without the arrow), is used. To make it explicit to the reader of this book, transpose of the forward gradient is used to denote the backward gradient. Thus, the definition of **F** used here is the same as that used in other books but expressed using the forward gradient operator (without using an arrow over the del operator). We note that
$$\mathbf{F} = (\nabla_0\mathbf{x})^{\mathrm{T}} = \frac{\partial x_i}{\partial X_J}\left(\hat{\mathbf{E}}_J\hat{\mathbf{e}}_i\right)^{\mathrm{T}} = x_{i,J}\hat{\mathbf{e}}_i\hat{\mathbf{E}}_J = F_{iJ}\hat{\mathbf{e}}_i\hat{\mathbf{E}}_J$$
   whereas

$$\nabla_0 \mathbf{x} = \hat{\mathbf{E}}_J \frac{\partial}{\partial X_J}\left(x_i \hat{\mathbf{e}}_i\right) = \frac{\partial x_i}{\partial X_J}\left(\hat{\mathbf{E}}_J \hat{\mathbf{e}}_i\right) = x_{i,J} \hat{\mathbf{E}}_J \hat{\mathbf{e}}_i \equiv F_{iJ} \hat{\mathbf{E}}_J \hat{\mathbf{e}}_i = \mathbf{F}^{\mathrm{T}}.$$

7. **Page 72**: In Figure 3.3.2, L should be the length of the reference configuration and l should be the length of the current configuration (without using $\alpha = \lambda$).
8. **Page 77**: When $\gamma = 1$, Mathematica evaluates the integral to be $3\pi bh$.
9. **Page 78**:
   - Replace the words "The transpose of **C** is denoted by **B** and it is called …" at the top of the page with "The *left Cauchy-Green deformation tensor*, or *Finger tensor*, **B**, is defined by"
   - The text right below Eq. (3.4.9), change "left" to "right" **.**
   - 4th line below Eq. (3.4.9), add I to read $I \neq J$ (I is missing).

10. **Page 79**: In the footnote, add hat to the second bold symbol **E.**
11. **Page 80**: The text above Eq. (3.4.16), remove the text inside () because
    $\Lambda_1 = \lambda - 1 \Rightarrow E_{11} = \tfrac{1}{2}(\lambda^2 - 1) = \tfrac{1}{2}(\lambda - 1)(\lambda + 1) = \tfrac{1}{2}\Lambda_1(\Lambda_1 + 2) = \tfrac{1}{2}\Lambda_1{}^2 + \Lambda_1$
12. **Page 81**: Eq. (3.4.19), add "cos" on the left side of the equality. Also, in the text below this equation, replace γ_1 and γ_2 with λ_1 and λ_2, respectively.
13. **Page 83**:
    - Reference to Figure 3.4.3 in Part (a) of solution in Example 3.4.2 should be changed to Figure 3.4.4.
    - The inverse mapping should be

$$X_1 = (-1 + x_1 - x_2)$$

$$X_2 = \frac{1}{3}(2x_2 - 7)$$

Therefore the column vector should read $-\frac{1}{3}\begin{Bmatrix}3\\7\end{Bmatrix}$ and the inverse mapping should read

$$\chi^{-1}(\mathbf{x}) = (-1 + x_1 - x_2)\hat{\mathbf{E}}_1 + \frac{1}{3}(-7 + 2x_2)\hat{\mathbf{E}}_2 + x_3\hat{\mathbf{E}}_3$$

14. **Page 84**: The values of the Green strain tensor in part (d) should be divided by 2:

$$\frac{1}{4}\begin{bmatrix}0 & 3\\3 & 7\end{bmatrix} \qquad \frac{1}{4}\begin{bmatrix}0 & 9\\9 & -4\end{bmatrix}$$

15. **Page 91**:
    - In Eq. (3.5.8), change the sign in front of Ω to minus ($\equiv \varepsilon - \Omega$).
    - Add minus sign to the right hand side of the equality in Eq. (3.5.9):

$$\Omega = -\tfrac{1}{2}[\nabla\mathbf{u}\text{-}(\nabla\mathbf{u})^{\mathrm{T}}] \qquad (3.5.9)$$

   - Add ½ to the definition of Ω_{ij} in Eq. (3.5.10):

$$\Omega_{ij} = \tfrac{1}{2}(u_{j,i} - u_{i,j})$$

- Add minus sign and remove ½ in front of the matrix in Eq. (3.5.11) :

$$[\Omega] = -\begin{bmatrix} 0 & -\Omega_{12} & -\Omega_{13} \\ \Omega_{12} & 0 & -\Omega_{23} \\ \Omega_{13} & \Omega_{23} & 0 \end{bmatrix} = \begin{bmatrix} 0 & \Omega_{12} & \Omega_{13} \\ -\Omega_{12} & 0 & \Omega_{23} \\ -\Omega_{13} & -\Omega_{23} & 0 \end{bmatrix}$$

- The third expression in the last equation on the page (without an equation number) has bold face ω; it should be light face.

$$u_i = \Omega_{ij} x_j = -e_{ijk}\omega_k x_j = -(\mathbf{x}\times\omega)_i \quad \text{or} \quad \mathbf{u} = \omega\times\mathbf{x},$$

16. **Page 96**:
    - Add transpose to $\nabla\mathbf{v}$ in the third line of the first paragraph of Section 3.6.1 [$\mathbf{L} \equiv (\nabla\mathbf{v})^{\mathrm{T}}$].
    - Add transpose to the first $\nabla\mathbf{v}$, change plus sign to minus in the second expression, and minus sign to plus in front of **W** in Eq. (3.6.1), as shown below:

      $$\mathbf{L} = (\nabla\mathbf{v})^{\mathrm{T}} = \tfrac{1}{2}[(\nabla\mathbf{v})^{\mathrm{T}} + \nabla\mathbf{v}] - \tfrac{1}{2}[\nabla\mathbf{v} - (\nabla\mathbf{v})^{\mathrm{T}}] \equiv \mathbf{D} + \mathbf{W}, \quad (3.6.1)$$

    - Remove the minus sign after the equal sign in the expressions for **W** in Eq. (3.6.3).

17. **Page 97**:
    - Add another "*d*" to the second *d***x** on the right hand side of Eq. (3.6.7).
    - Make v boldface and add transpose to $\nabla\mathbf{v}$ in the second line of the paragraph above Eq. (3.6.10) [$\mathbf{L} = (\nabla\mathbf{v})^{\mathrm{T}}$].

18. **Page 177**: Add transpose to $\nabla\mathbf{v}$ in the last equation of the page [$\mathbf{L} \equiv (\nabla\mathbf{v})^{\mathrm{T}}$]
19. **Page 279**: Add ½ to the right side of the equal sign in the two expressions of Eq. (8.1.31) so that it is consistent with the definition of vorticity.
20. **Page 280**: Add ½ to the right side of the equal sign in the two expressions of Eq. (8.1.32).
21. **Page 329**: Example 9.3.3, Last sentence of the problem statement of Example 9.3.3 should be modified to read "Determine the load for the viscoelastic response of the Maxwell and Kelvin models."