Introduction to Biomedical Engineering

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Errata for Third Printing

Page 133, near the bottom of the page:
"In general, a set of forces may be combined into an equivalent force denoted by the resultant, R, where..."

Page 145
Example Problem 4.5
A 160-lb person is holding a 10-lb weight in his palm with the elbow fixed at 90° flexion (Fig. 4.8, top). (a) What force must the biceps generate to hold the forearm in static equilibrium? (b) What force(s) does the forearm exert on the humerus?

Solution
Figure 4.8 (bottom) shows the free-body diagram of this system. Due to the increased number of unknowns, compared to the previous example, both Eqs. 4.35 and 4.36 will be used. From the anthropometric relationships in Table 4.1, the segment weight (forearm and hand) is approximated as 2.2% of total body weight with the segment center of mass located 68.2% of the segment length away from the elbow axis. Note that the segment length for the "forearm and hand" segment in Table 4.1 is defined as the distance between the elbow axis and the ulnar styloid.

Summing moments about the point of application of the biceps force at point O, the equilibrium equation $\Sigma \mathbf{M}_O = \mathbf{0}$ can be written as

$$\mathbf{r}_{OE} \times \mathbf{F}_A + \mathbf{r}_{OB} \times (-10 \text{ lb})\mathbf{j} + \mathbf{r}_{OP} \times (-3.5 \text{ lb})\mathbf{j} = 0$$

$$(-2 \text{ in})\mathbf{i} \times (-F_A)\mathbf{j} + (12 \text{ in})\mathbf{i} \times (-10 \text{ lb})\mathbf{j} + (5.2 \text{ in})\mathbf{i} \times (-3.5 \text{ lb})\mathbf{j} = 0$$

$$(2 \text{ in})F_A\mathbf{k} - (120 \text{ lb in})\mathbf{k} - (18.2 \text{ lb in})\mathbf{k} = 0$$

Solving this last expression for the one unknown, F_A, the vertical force at the elbow:

$$F_A = 69.1 \text{ lb}$$

To find the unknown horizontal force at the elbow, F_C, and the unknown force the biceps must generate, F_B, the other equation of equilibrium $\Sigma\mathbf{F} = \mathbf{0}$ is used:

$$F_C\mathbf{i} - F_A\mathbf{j} + (-F_B \cos 75° \mathbf{i} + F_B \sin 75° \mathbf{j}) - 10 \text{ lb } \mathbf{j} - 3.5 \text{ lb } \mathbf{j} = \mathbf{0}$$

Summing the **i** and **j** components gives

$$F_C - F_B \cos (75°) = 0$$
$$-F_A + F_B \sin (75°) - 10 \text{ lb} - 3.5 \text{ lb} = 0$$

Solving these last two equations simultaneously and using F_A = 69.1 lb gives the force of the biceps muscle, F_B, and the horizontal elbow force, F_C:

$$F_B = 85.5 \text{ lb}$$
$$F_C = 22.1 \text{ lb}$$

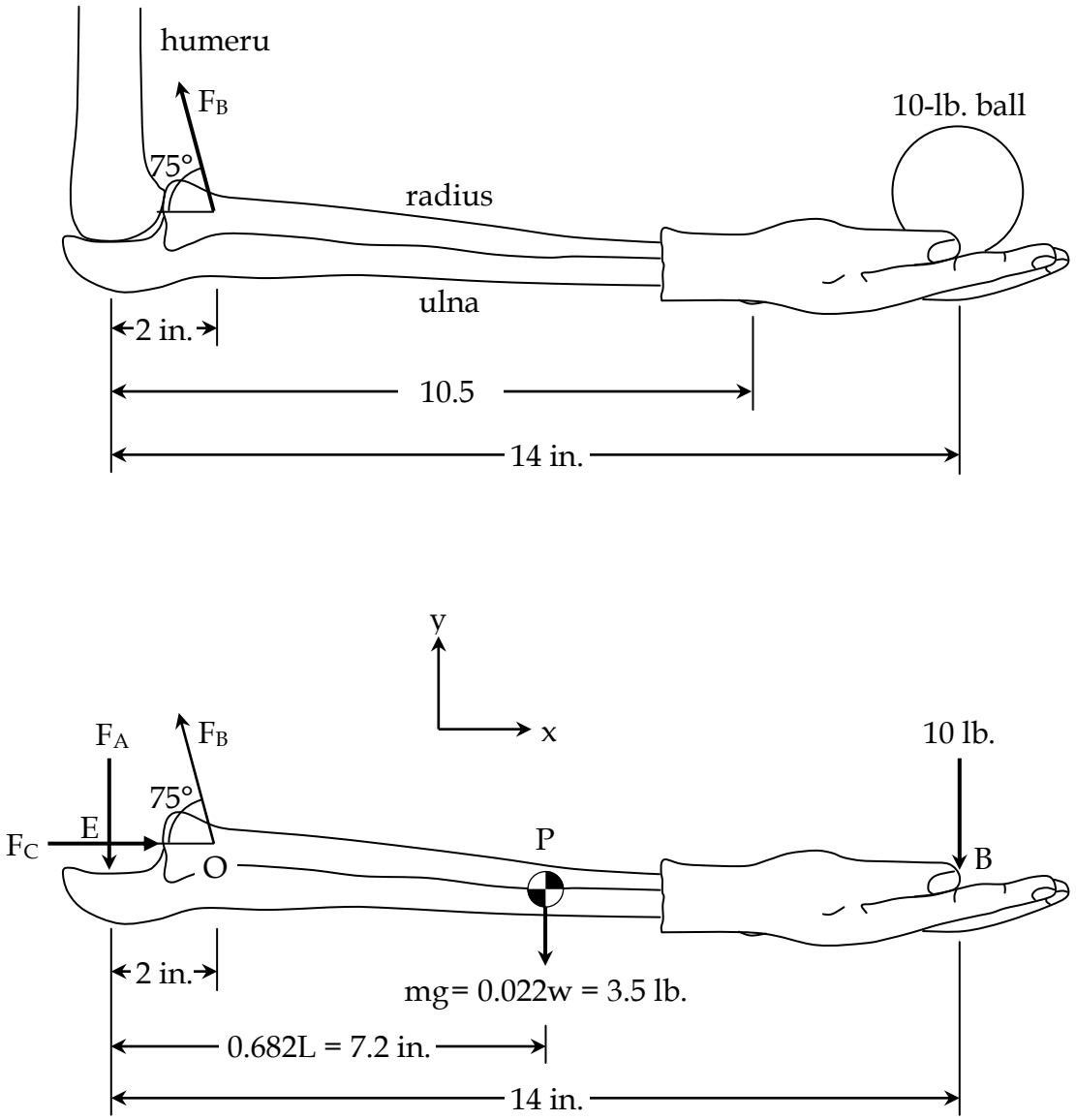


Figure 4.8 (top) The forearm held statically fixed in 90° flexion while holding a 10-lb weight in the hand. (bottom) Free-body diagram of the forearm system (adapted from Davis, 1986, Figs. 6.16 and 6.17, pp. 208–9).

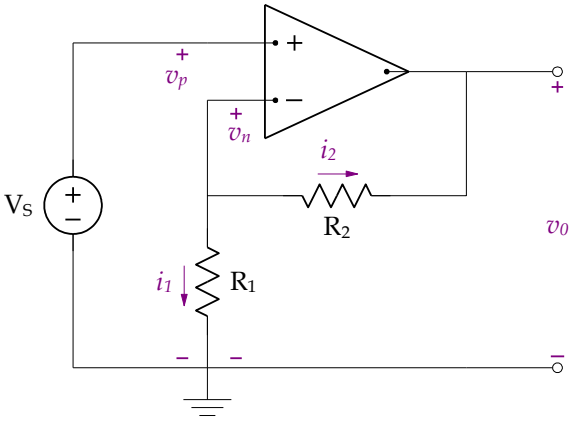
Page 406, Figure 8.1. "1895 Roeritgen" should be "1895 Roentgen"

Page 413 Figure 8.9, the current in B is incorrectly labeled $p=vi$, it should be just i.

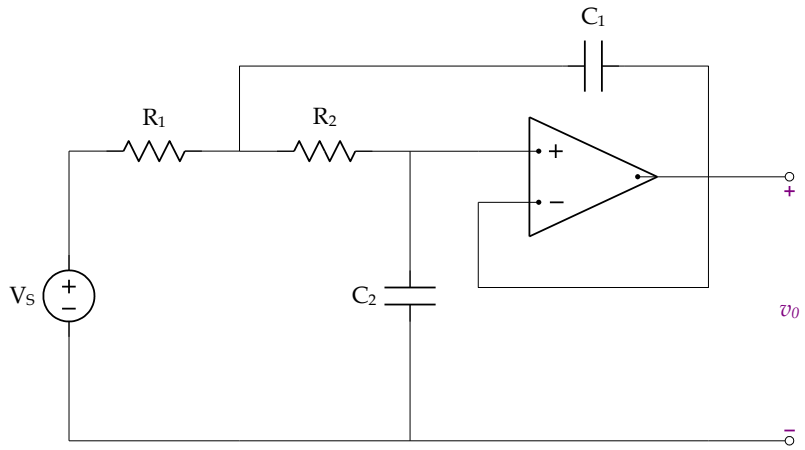
Page 422, The P's below the circuit at the top of the page should be ||.

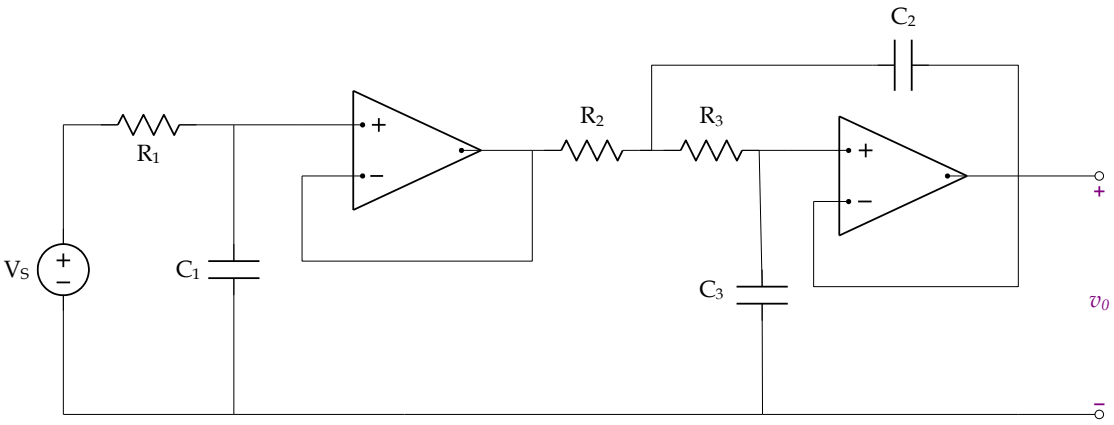
Page 446, third line after title, 8.10 has circuit incorrectly spelled as “cirucuit”.

Page 460, Figure for Example 8.19 should be



Page 484. Figure 8.38, circuits are wrong. It should be





Page 550: Sec: 10.1 Introduction - third line of the first paragraph:

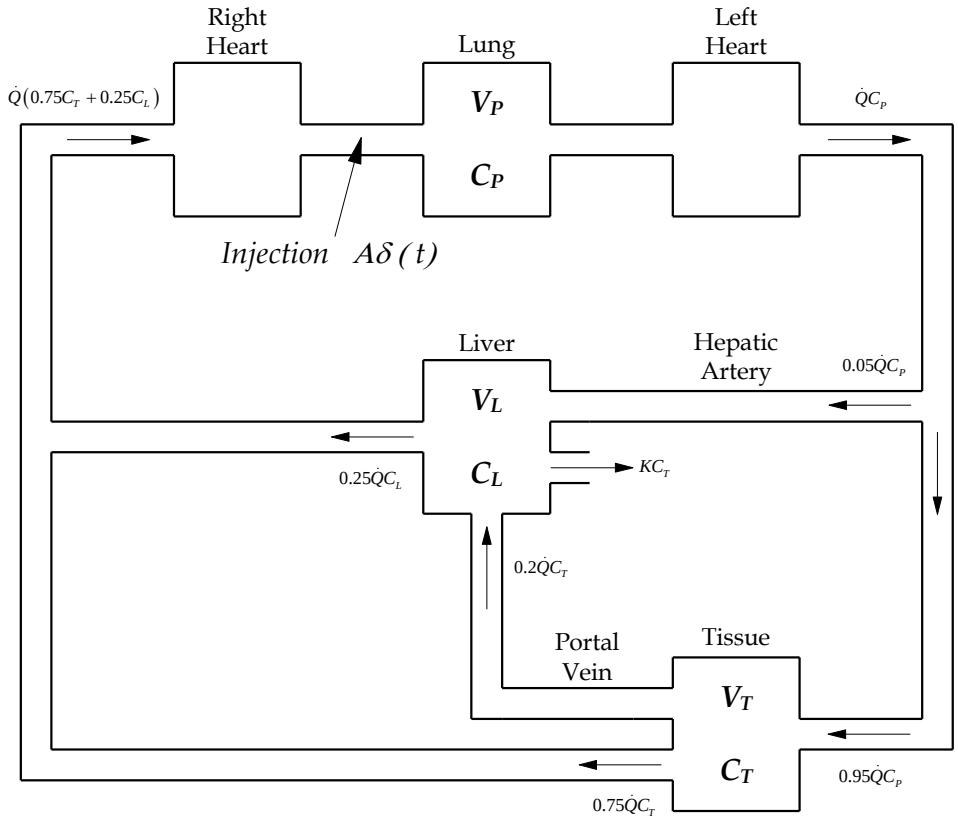
"...mechanical activity that occurs during these biological events often produces signals..."

Page 658

Eq. 11.36 should not have a negative sign

$$V_{Th} = \frac{R_{Na}R_{Cl}E_K + R_K R_{Cl}E_{Na} + R_K R_{Na}E_{Cl}}{R_{Na}R_{Cl} + R_K R_{Cl} + R_K R_{Na}}$$

Page 719, Figure has been updated



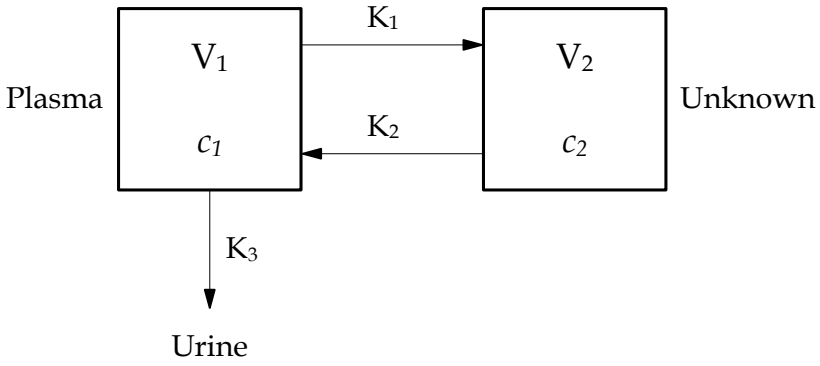
Page 722
Above the Figure, it should be $t_d < 4\tau$ and $t_d > 4\tau$
Page 789

Ex. 5.

A_1 = 143 mg/100 mL
A_2 = 57 mg/100 mL

The amount of substance injected equals 10 g.

Figure should be



Page 790
Part (b) of Exercise 7, change to

(b) Determine the transfer rates K_{12}, K_{13}, and K_{21}.

Page 791
Problem 10, "Exercise 12.1" should be "Example Problem 12.1".

Page 795 Error in the nonlinear spring in Figure