

ERRATA SHEET

Applied Occupational Ergonomics – A Textbook, 2nd Edition (2007), 1st Print
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Page#	Paragraph#	Line#	Description
14	2	7	Replace the word “Ligamen” with the word “Ligament”
15	5	1	Replace the word “occupation” with the word “occupational”
20	17	36	Replace the word “Tranverse” with the word “Transverse”
28	-	-	Figure 3.1. Unmarked dimension for top right figure of seated human. The first vertical line is the dimension for seated height (#8).
47	2	3	Replace the word “intertia” with the word “inertia”
51	5	4	Replace “Figure 4.2” with “Figure 4.3”
71	4	1	Add “to” after the word “due”
71	4	5	Add “to” after the word “due”
87	1	1	Replace the word “human” with the word “ humans”
87	1	11	Replace the word “human” with the word “ humans”
87	3	6	Replace the word “form” with the word “from”
88	1	2	Delete the word “or” after the word “on”
88	3	8	Replace the word “form” with the word “from”
89	3	8	Replace the word “form” with the word “from”
111	1	3	Replace the words “Chapter 12” with “Chapter 8”
140	3	5	Replace “Ayoun et al, (1986) ” with “Ayoub et al. (1986) ”
169	-	-	Figure 11.3. The “Green Zone” shading is not visible. The “Green Zone” includes row 0 (columns 0, 1, 2, 3), rows 1 and 2 (columns 1, 2, 3), rows 3, 4, and 5 (columns 1)
195	3	6	Replace the word “bones” with the word “bone”

Page#	Paragraph#	Line#	Description
210	2	5	<p>Replace Equation 13.1. $BMI = \frac{Height(inches)}{Weight^2(lbs.)}$</p> <p>with $BMI = \frac{Weight(lbs.)}{Height^2(inches)} * 703$ (US units)</p> <p>with $BMI = \frac{Weight(kg)}{Height^2(m)}$ (SI units)</p>
213	-	11	(References section) Include the word “and” after Kuczmariski, R.J., Johnson C.L. (1998)
213	-	21	Replace “&” with the word “and” after Hager-Ross, C., & Rosbald, B. (2002).

Example 4.2.: Two Link Planer Model (REVISED – June 2009)

Assume the free body diagram in Figure 4.3 represents the human arm system with the elbow as the fulcrum. The distance “b” (= 17”) is the distance from the fulcrum to center of load being held, the distance “c” (= 11”) is the distance from the muscle insertion to the top of the upper-arm shoulder joint, and the weight of load that can be held in the palm is 20 lbs. Assume the weight of the hand-forearm and upper arm is negligible and there is no movement. Determine the forces (R_S) and moments (M_S) at the shoulder assuming that the upper arm and forearm-hand is held horizontal to the ground.

Solution

In Example 4.1, the hand and forearm was considered as one body segment (i.e. a single link). In this example, the upper arm is considered as a second body segment (i.e. a second link). In order to perform the analyses on the second link, the forces and moments on the first link will have to be computed and then transferred to the second link. Considering only the first link, the reaction force at the elbow (R_E) and the moment at elbow (M_E) can be calculated as follows:

$$\Sigma \text{Forces} = 0$$

$$-20 \text{ lbs} + R_E = 0; \text{ therefore, } R_E = 20 \text{ lbs (acting upwards)}$$

$$\Sigma \text{Moments} = 0$$

$$-20 \text{ lbs} * 17'' + M_E = 0; \text{ therefore, } M_E = 340 \text{ lbs-in (acting counter-clockwise)}$$

Now considering only the second link: the upper arm, the reaction force at the elbow (R_E') and moment at elbow (M_E') is opposite in direction but equal in magnitude to R_E and M_E , respectively.

$$\Sigma \text{Forces} = 0$$

$$-R_E' + R_S = 0; \text{ therefore, } R_S = 20 \text{ lbs (acting upwards)}$$

$$\Sigma \text{Moments} = 0$$

$$-R_E' * 11'' - M_E' + M_S = 0; \text{ therefore, } M_S = 20 * 11 + 340 \text{ lbs-in} = 560 \text{ lbs-in (acting counter-clockwise)}$$

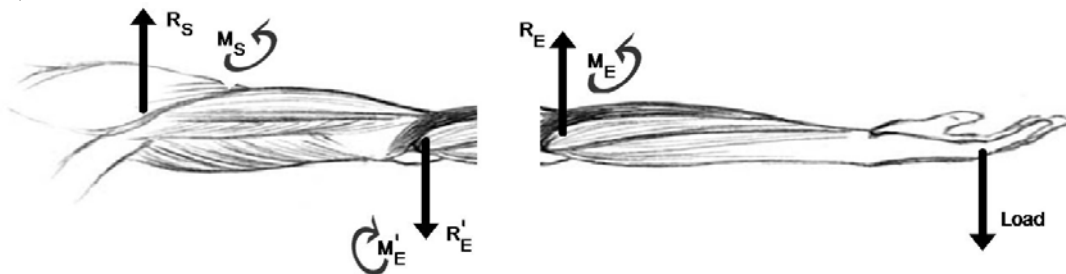


Figure 4.3
Free body diagram for Example 4.2

Note: In the above examples, the weight of the hand and forearm was neglected. Also, only static cases were examined. If dynamic cases were to be analyzed, one would require mass, center-of-mass, moments of inertia, etc. of the body segments. The analyses of dynamic models are beyond the purview of this text and for further information on this refer to Chaffin et al., (2006).