

Problem 2.2-10

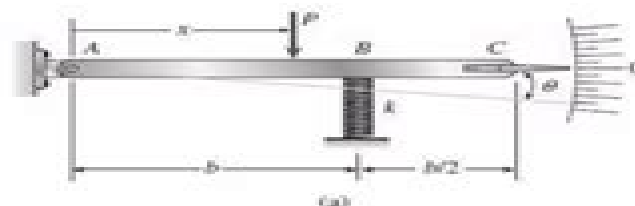
NUMERICAL DATA: $k = 950 \text{ N/m}$ $b = 165 \text{ mm}$ $P = 11 \text{ N}$ $\theta = 2.5^\circ$ $\theta_{\max} = 2^\circ$

$W_p = 3 \text{ N}$ $W_s = 2.75 \text{ N}$

- (a) If the load $P = 11 \text{ N}$, at what distance x should the load be placed so that the pointer will read $\theta = 2.5^\circ$ on the scale (see Fig. a)?

Sum moments about A, then solve for x :

$$x = \frac{k \theta b^2}{P} = 102.6 \text{ mm} \quad \boxed{x = 102.6 \text{ mm}}$$

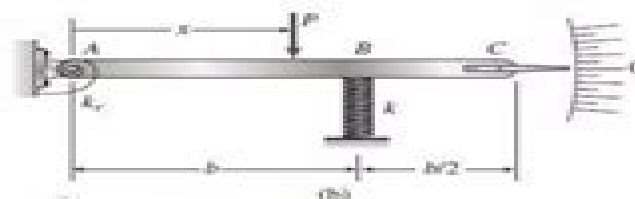


- (b) Repeat (a) if a rotational spring $k_r = kb^2$ is added at A (see Fig. b).

$$k_r = k b^2 = 25864 \text{ N}\cdot\text{mm}$$

Sum moments about A, then solve for x :

$$x = \frac{k \theta b^2 + k_r \theta}{P} = 205 \text{ mm} \quad \frac{x}{b} = 1.244 \quad \boxed{x = 205 \text{ mm}}$$



- (c) Now if $x = 7b/8$, what is P_{\max} (N) if θ cannot exceed 2° ? $x = \frac{7}{8} b = 144.375 \text{ mm}$

$$\text{Sum moments about A, then solve for } P: \quad P_{\max} = \frac{k \theta_{\max} b^2 + k_r \theta_{\max}}{\frac{7}{8} b} = 12.51 \text{ N} \quad \boxed{P_{\max} = 12.51 \text{ N}}$$

- (d) Now, if the weight of the pointer ABC is known to be $W_p = 3 \text{ N}$ and the weight of the spring is $W_s = 2.75 \text{ N}$, what initial angular position (i.e., θ in degrees) of the pointer will result in a zero reading on the angular scale once the pointer is released from rest? Assume $P = k_r = 0$.

Deflection at spring due to W_p :

$$\delta_{sp} = \frac{W_p \left(\frac{3}{4} b \right)}{k b} = 2.368 \text{ mm}$$

Deflection at B due to self weight of spring:

$$\delta_{st} = \frac{W_s}{2k} = 1.447 \text{ mm}$$

$$\delta_B = \delta_{sp} + \delta_{st} = 3.816 \text{ mm} \quad \theta_{ini} = \frac{\delta_B}{b} = 1.325^\circ$$

$$\text{OR } \theta_{ini} = \arctan \left(\frac{\delta_B}{b} \right) = 1.325^\circ \quad \boxed{\theta_{ini} = 1.325^\circ}$$

Mechanics Of Materials Goodno Solutions

David Kirk



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Intermediate Solid Mechanics Marko V. Lubarda,Vlado A. Lubarda,2020-01-09 A concise yet comprehensive treatment of the fundamentals of solid mechanics including solved examples exercises and homework problems

Mechanical Behavior of Materials Zainul Huda,2021-12-01 This textbook supports a range of core courses in undergraduate materials and mechanical engineering curricula given at leading universities globally It presents fundamentals and quantitative analysis of mechanical behavior of materials covering engineering mechanics and materials deformation behavior fracture mechanics and failure design This book provides a holistic understanding of mechanical behavior of materials and enables critical thinking through mathematical modeling and problem solving Each of the 15 chapters first introduces readers to the technologic importance of the topic and provides basic concepts with diagrammatic illustrations and then its engineering analysis mathematical modelling along with calculations are presented Featuring 200 end of chapter calculations worked examples 120 diagrams 260 equations on mechanics and materials the text is ideal for students of mechanical materials structural civil and aerospace engineering

Manufacturing Process Planning José V. Abellán-Nebot,Carlos Vila Pastor,Héctor R. Siller,2025-02-04 Comprehensive introduction to manufacturing process planning in the context of the latest techniques being used in industry Manufacturing Process Planning is a comprehensive guide to the intricacies of the manufacturing planning process that leads readers through each stage of planning while providing practical examples that illustrate the manufacturing activities taking place at every juncture Beginning with the fundamentals the book bridges the gap between technical documents and product specifications and how the information they contain can be effectively applied on the shop floor The book focuses around four key areas selection of manufacturing processes process planning in sand casting process planning in machining and process planning in inspection Each chapter

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