



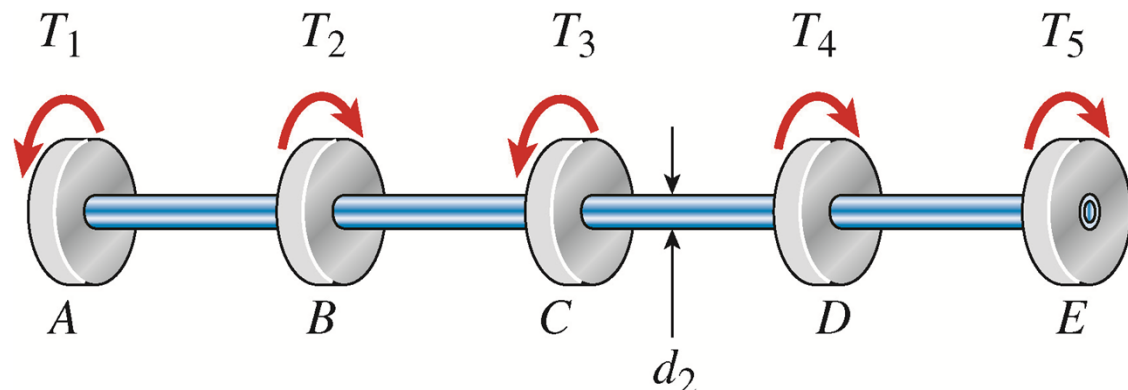
# 作業8、11/22習題

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- 3.4-5、3.4-12、3.4-16
- 3.5-2、3.5-7
  
- 11月29日 上課前繳交

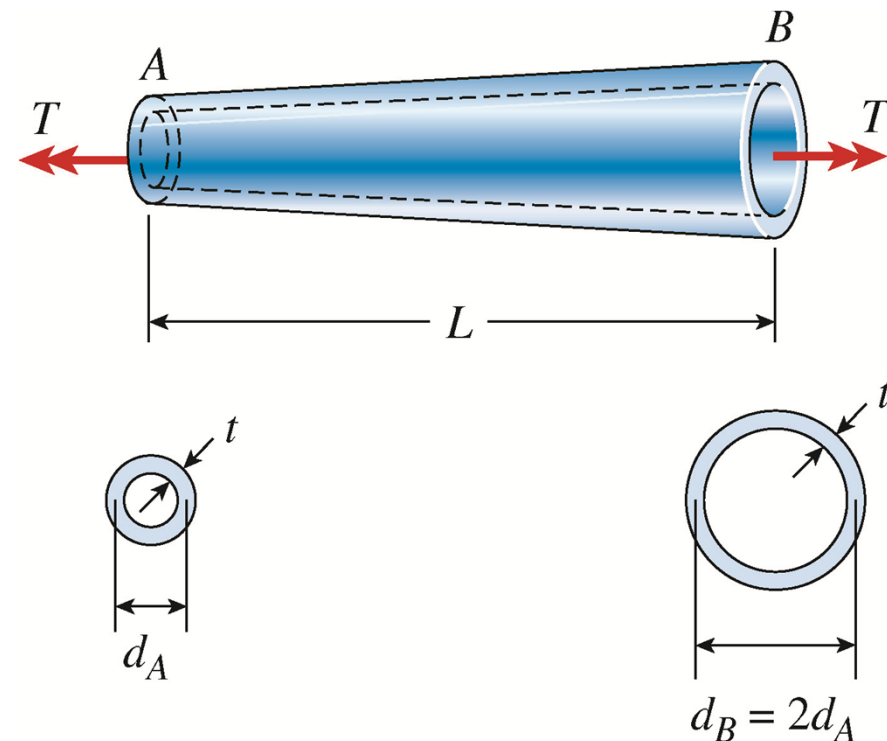
## 3.4-5

- A hollow tube  $ABCDE$  constructed of monel metal is subjected to five torques acting in the directions shown in the figure. The magnitudes of the torques are  $T_1 = 100$  N.m,  $T_2 = T_4 = 50$  N.m, and  $T_3 = T_5 = 80$  N.m. The tube has an outside diameter  $d_2 = 25$  N.m. The allowable shear stress is 12,000 psi and the allowable rate of twist is  $6^\circ/\text{m}$ .
- Determine the maximum permissible inside diameter  $d_1$  of the tube.



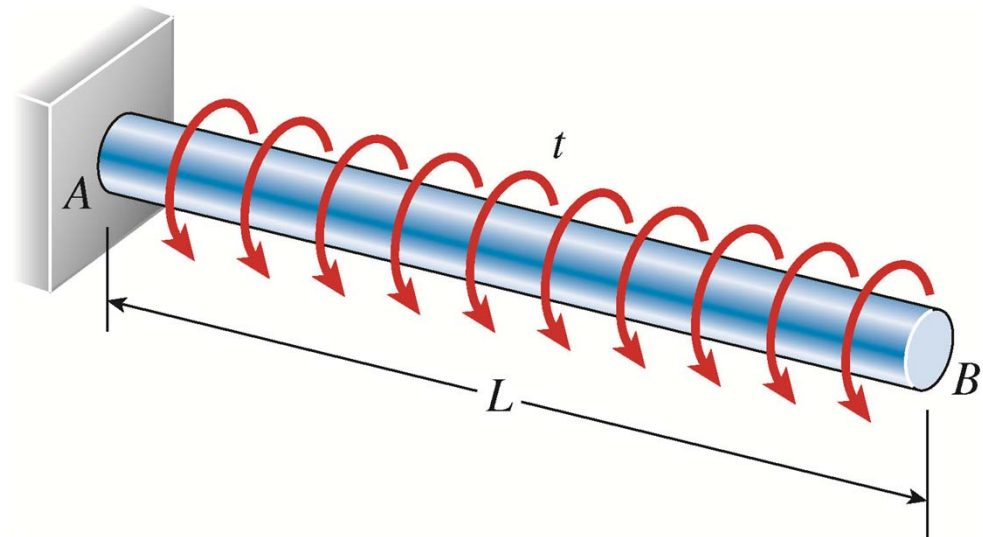
## 3.4-12

- A uniformly tapered tube  $AB$  of hollow circular cross section is shown in the figure. The tube has constant wall thickness  $t$  and length  $L$ . The average diameters at the ends are  $d_A$  and  $d_B = 2d_A$ . The polar moment of inertia may be represented by the approximate formula  $I_p = \pi d^3 t / 4$
- Derive a formula for the angle of twist  $\phi$  of the tube when it is subjected to torques  $T$  acting at the ends.



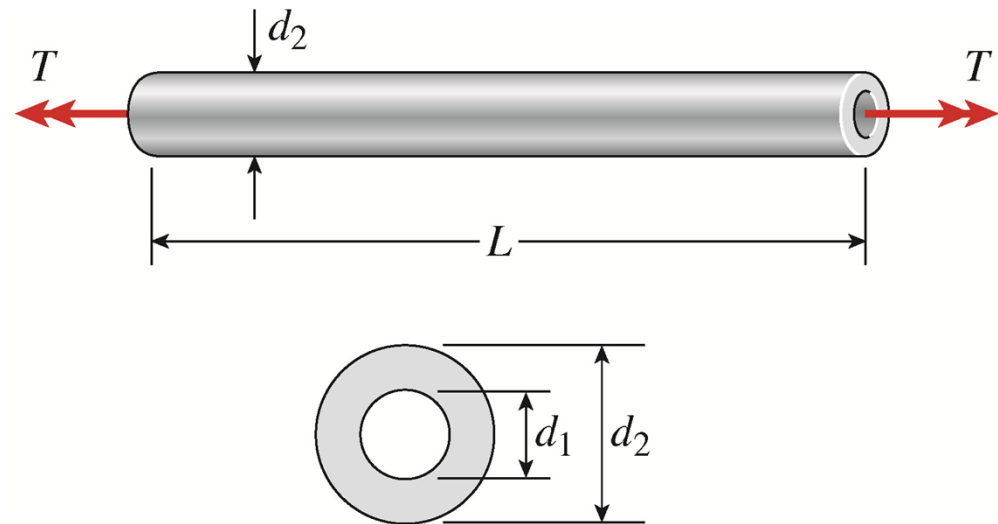
## 3.4-16

- A prismatic bar  $AB$  of length  $L$  and solid circular cross section (diameter  $d$ ) is loaded by a distributed torque of constant intensity  $t$  per unit distance (see figure).
- (a) Determine the maximum shear stress  $\tau_{\max}$  in the bar.
- (b) Determine the angle of twist between the ends of the bar.



## 3.5-2

- A hollow steel bar ( $G=80$  GPa) is twisted by torques  $T$ . The twisting of the bar produces a maximum shear strain  $\gamma_{\max}=640\times 10^6$  rad. The bar has outside and inside diameters of 150 mm and 120 mm, respectively.
  - Determine the maximum tensile strain in the bar.
  - Determine the maximum tensile stress in the bar.
  - What is the magnitude of the applied torques  $T$ ?



## 3.5-7

- The normal strain in the  $45^\circ$  direction on the surface of a circular tube (see figure) is  $1860 \times 10^{-6}$  when the torque  $T = 200$  Nm. The tube is made of copper alloy with  $G = 47$  GPa. If the outside diameter  $d_2$  of the tube is 20 mm, what is the inside diameter  $d_1$ ?

