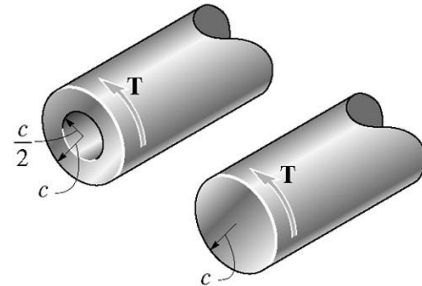
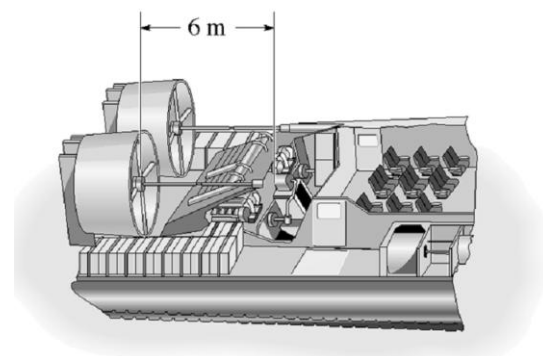


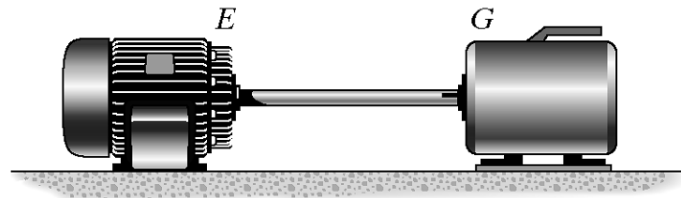
1. A shaft is subjected to a torque  $T$ . Compare the effectiveness of using the tube shown in the figure with that of a solid section of radius  $c$ . To do this, compute the percentage change in torsional stress and angle of twist per unit length.【图示空心圆轴承受扭矩  $T$ ，若以同样半径的实心圆轴替代，试求最大扭转切应力和单位长度扭转角的百分比改变量。】



2. The tubular drive shaft for the propeller of a hover-craft is 6 m long. If the motor delivers 4 MW of power to the shaft when the propellers rotate at 25 rad/s, determine the required inner diameter of the shaft if the outer diameter is 250 mm. What is the angle of twist of the shaft when it is operating? Take  $[\tau] = 90$  MPa and  $G = 75$  GPa.【图示气垫式运输机的推进驱动轴为一外直径为 250 mm、长 6 m 的空心轴，在功率为 4 MW 的推进电机驱动下以 25 rad/s 旋转，若该轴的许用切应力为  $[\tau] = 90$  MPa，剪切模量  $G = 75$  GPa，试求该轴最小所需内直径，并求对应的扭转角。】



3. The stainless steel shaft is 3 m long and has an outer diameter of 60 mm. When it is rotating at 60 rad/s, it transmits 30 kW of power from the engine  $E$  to the generator  $G$ . determine the smallest thickness of the shaft if the allowable shear stress is  $[\tau] = 150$  MPa and the shaft is restricted not to twist more than 0.08 rad.  $G = 80$  GPa. 【图示空心钢轴长 3 m，外直径 60 mm，以 60 rad/s 的转速由  $E$  向  $G$  传递 30 kW 的动力，若钢轴许用切应力为  $[\tau] = 150$  MPa，单位长度许用扭转角为  $[\varphi'] = 1.53$  degrees/m，试求该空心钢轴正常工作所需的壁厚。  $G = 80$  GPa。】



4. When drilling a well, the deep end of the drill pipe is assumed to encounter a torsional resistance  $T_A$ . Furthermore, soil friction along the sides of the pipe creates a linear distribution of torque per unit length, varying from zero at the surface  $B$  to  $t_0$  at  $A$ . Determine the necessary torque  $T_B$  that must be supplied by the drive unit to turn the pipe. Also, what is the relative angle of twist of one end of the pipe with respect to the other end at the instant the pipe is about to turn? The pipe has an outer radius  $r_o$  and an inner radius  $r_i$ . The shear modulus is  $G$ . 【图示空心钻管外半径为  $r_o$ ，内半径为  $r_i$ ，头部受到被钻岩土的作用扭矩  $T_A$ ，岩土层对钻管的反作用扭矩沿管呈线性分布：在地表  $B$  处为 0；在钻管头部  $A$  处为  $t_0$ 。试求驱动钻管所需的扭矩  $T_B$ ，并求头部  $A$  相对于驱动端  $B$  的扭转角。设钻管剪切模量为  $G$ 。】

