

1. (15%) As shown in Fig. 1, the weight of the horizontal wall section is  $W=1000\text{kg}$ , Determine the tensions in the cables AB, AC, and AD.

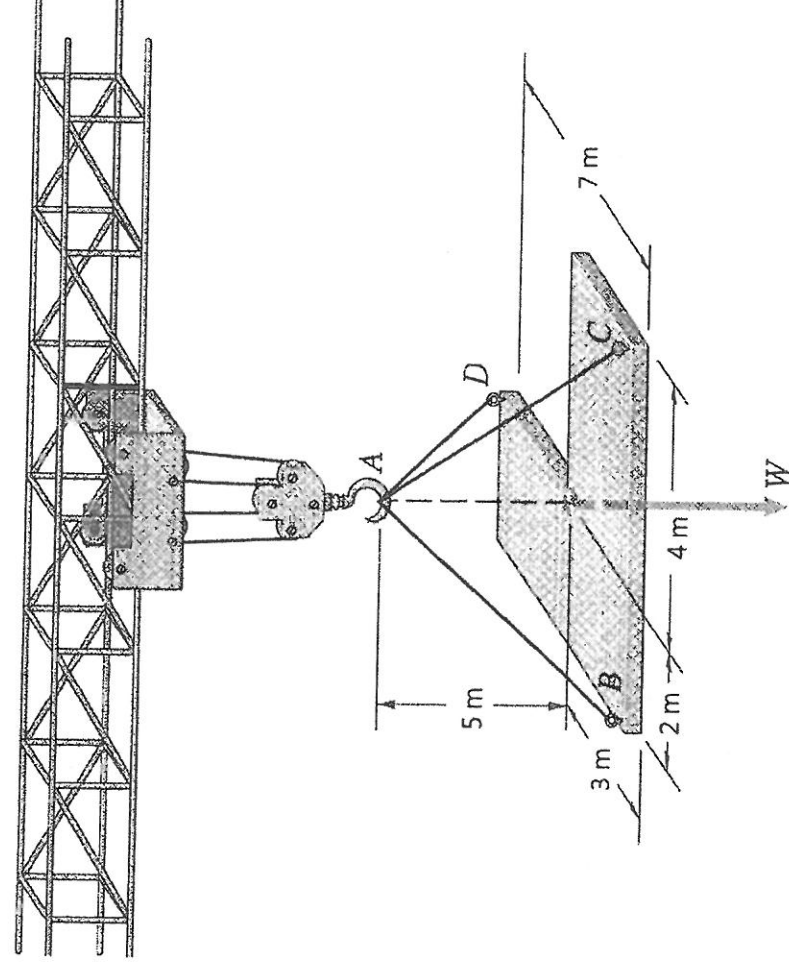


Fig. 1

2. (20%) As shown in Fig. 2, system 1 consists of two forces and a couple. Suppose that you want to represent it by a wrench (system2). Determine the force  $F$ , the couple  $M_p$ , and the coordinates  $x$  and  $z$  where the line of action of  $F$  intersects the  $x$ - $z$  plane.

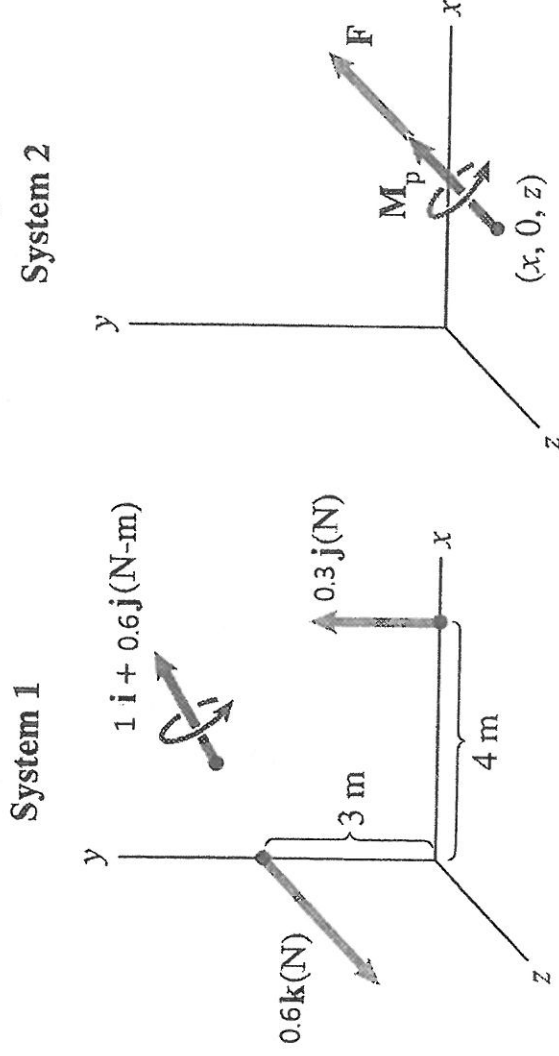


Fig. 2

3. (20%) As shown in Fig. 3, determine the axial forces in the member AB, AC, BC, BD, CD of the truss, and please state if the members are in tension or compression.

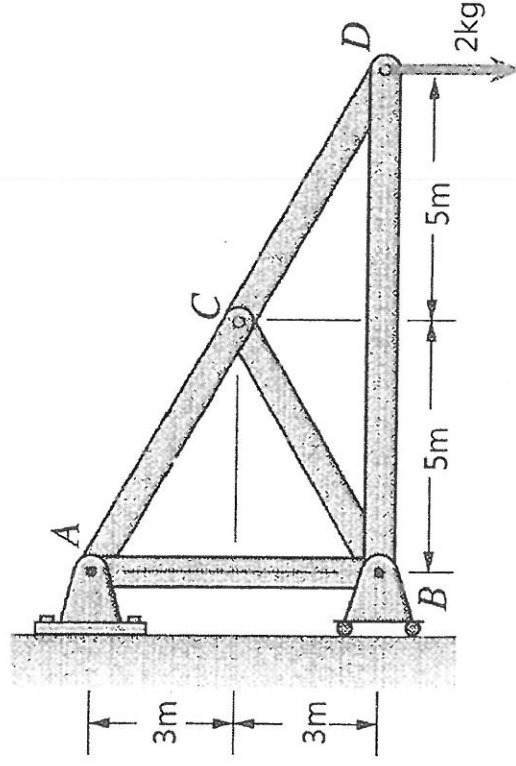


Fig. 3

4. (20%) Fig. 4 shows a circular, hollow tube with a radius  $R$  held in a vertical plane. This tube is open at both ends and is partially filled with water of density  $\rho$  through an arc of  $180^\circ$ . By pressurize one end of the tube, the water is displaced through an arbitrary angle  $\theta$ , and then the pressure is released. Neglecting the friction, (a)(10%) determine the moment about center  $O$  due to the weight of water and (b)(10%) determine the angular acceleration of the water in terms of angle  $\theta$ , density  $\rho$ , gravitational acceleration  $g$  and radius  $R$ .

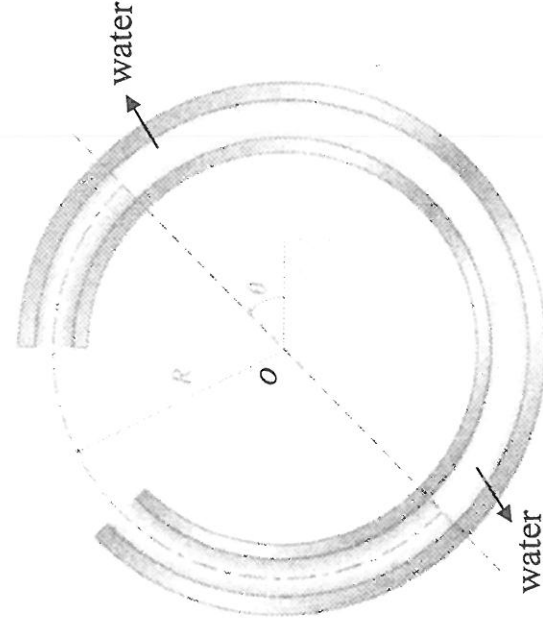


Fig. 4

5. (25%) As shown in Fig. 5, the rolling wheel has a radius  $r$ , and the wheel center is moving at a speed  $v_0$  and an acceleration  $a_0$ . The rod  $AB$  is hinged to the rolling wheel at point  $A$ ; and the other end maintains contact with the surface  $S$  at point  $B$ . The distance between points  $A$  and  $B$  is equal to the diameter of the wheel. For the position shown in Fig. 5,

(a) (15%) determine the velocity  $v$  of point  $B$  in terms of  $v_0$ ; and

(b) (10%) determine the acceleration  $a$  of point  $B$  in terms of  $v_0$ ,  $a_0$  and wheel radius  $r$ .

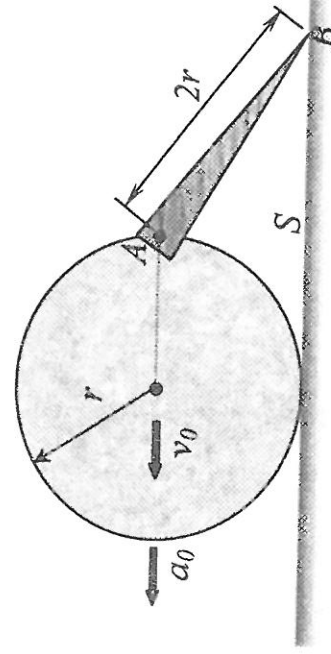


Fig. 5

