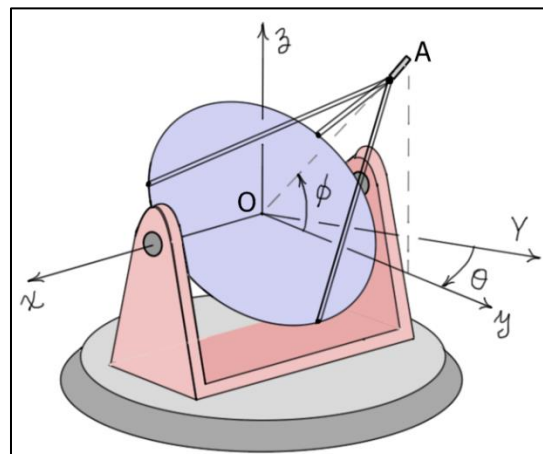
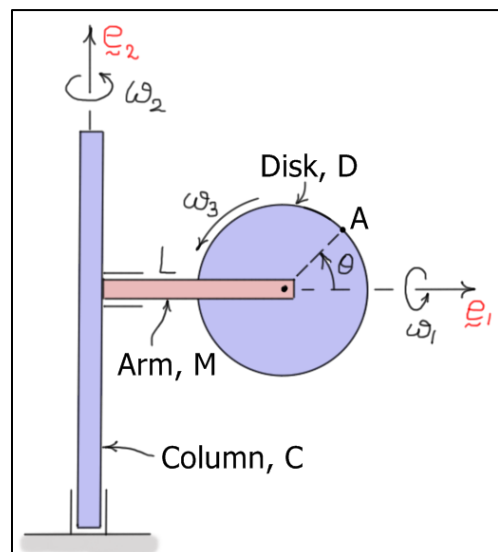


## ME 5550 Intermediate Dynamics Exercises #2B

- 1) The antenna system shown has two components, the base  $B$  and the antenna dish  $D$ . The distance from  $O$  to  $A$  is  $L$ . At any instant, the angle between the  $y$ -axis and the fixed  $Y$ -axis is given by the angle  $\theta$ , and the angle between  $OA$  and the  $y$ -axis is given by the angle  $\phi$ . Calculate  $\underline{v}_A$  and  $\underline{a}_A$  the velocity and acceleration of point  $A$  using the formulae for a point **moving** on a body. (The problem comes from Hibbeler, *Engineering Mechanics*, 1998)



- 2) The system shown has three components, a vertical column  $C$ , a horizontal arm  $M$ , and a disk  $D$ . The disk has radius  $r$  and rotates relative to the arm at a rate of  $\omega_3$  (rad/sec). The arm has length  $L$  and rotates relative to the column at a rate of  $\omega_1$  (rad/sec). The column rotates at a rate of  $\omega_2$  (rad/sec). Calculate  $\underline{v}_A$  and  $\underline{a}_A$  the velocity and acceleration of point  $A$  using the formulae for a point **moving** on a body. The angular rates  $\omega_i$  ( $i = 1, 2, 3$ ) are **not** constant.



- 3) The position of the stylus tip  $A$  is controlled by the mechanism shown. At the instant shown,
- The stylus has a **constant** speed  $u = 150$  (mm/sec) relative to arm  $CD$ .
  - Arm  $CD$  rotates at a **constant** rate  $\omega_2 = 1.6$  (rad/sec) relative to  $DEG$ .
  - Arm  $DEG$  rotates at a **constant** rate  $\omega_1 = 1.2$  (rad/sec) relative to the ground.

Calculate  $\underline{v}_A$  and  $\underline{a}_A$  the velocity and acceleration of  $A$  for the instant shown.

(The problem comes from Beer & Johnston, *Vector Mechanics for Engineers*, 1984)

