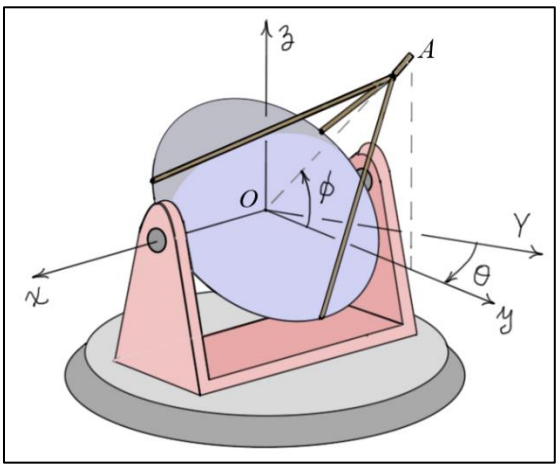
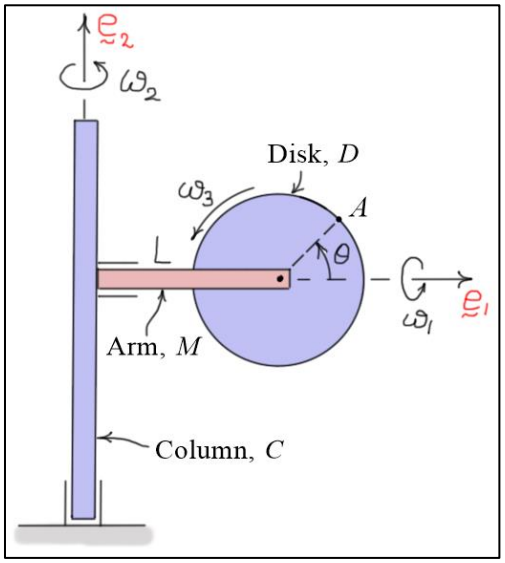
Intermediate Dynamics
Exercises #2B

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 θ, and the angle between *OA* and the *y*-axis is given by the angle ϕ. Calculate $\underset{\sim}{v}_A$ and $\underset{\sim}{a}_A$ 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)

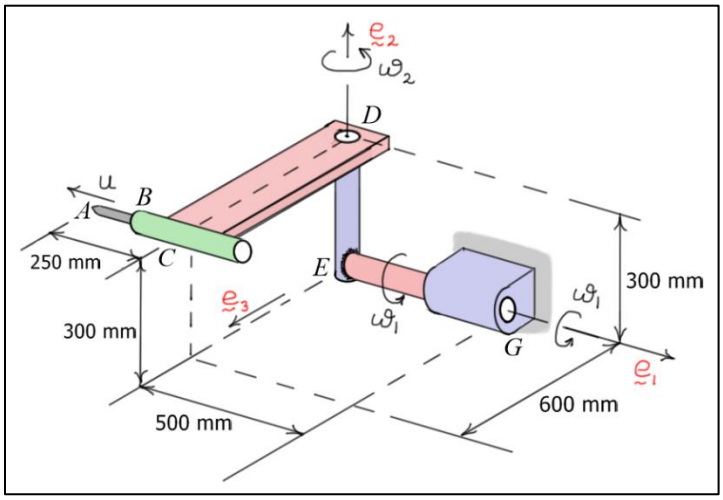


2) The system shown has three components, a vertical column *C*, a horizontal arm *M*, and a disk *D*. The disk has radius r and rotates relative to the arm at a rate of ω_3 (rad/sec). The arm has length *L* and rotates relative to the column at a rate of ω_1 (rad/sec). The column rotates at a rate of ω_2 (rad/sec). Calculate $\underset{\sim}{v}_A$ and $\underset{\sim}{a}_A$ the velocity and acceleration of point *A* using the formulae for a point ***moving*** on a body. The angular rates ω_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 $\underset{\sim}{v}_A$ and $\underset{\sim}{a}_A$ the velocity and acceleration of *A* for the instant shown.



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