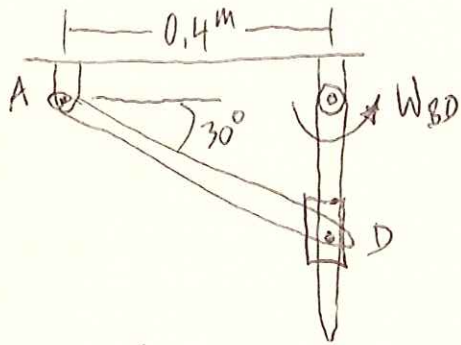


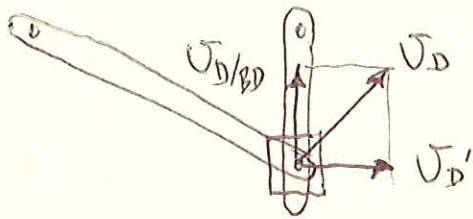
PROB. 15-176



$$\omega_{BD} = 6 \frac{\text{RAD}}{\text{s}} \curvearrowright$$

FIND  $\omega_A$ ,  $\alpha_A$

$$\vec{v}_D = \vec{v}_{D'} + \vec{v}_{D/BD}$$



$$\vec{v}_{D'} = \omega_{BD} \hat{k} \times \vec{r}_{D'/B}$$

$$\vec{v}_{D'} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 6 \\ 0 & -0.2309 & 0 \end{vmatrix}$$

$$\vec{v}_{D'} = (1.386) \hat{i} \frac{\text{m}}{\text{s}}$$

$$\vec{v}_D = \omega_A \hat{k} \times \vec{r}_{D/A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega_A \\ 0.4 & -0.2309 & 0 \end{vmatrix}$$

$$= [0 - (\omega_A)(-0.2309)] \hat{i} - [0 - (\omega_A)(0.4)] \hat{j}$$

$$\vec{v}_D = (0.2309 \omega_A) \hat{i} + (0.4 \omega_A) \hat{j} \frac{\text{m}}{\text{s}}$$

$$\vec{v}_{D/BD} = (v_{D/BD}) \hat{j}$$

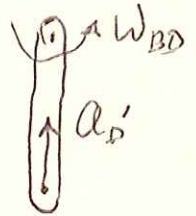
$$(0.2309 \omega_A) \hat{i} + (0.4 \omega_A) \hat{j} = (1.386) \hat{i} + (v_{D/BD}) \hat{j}$$

$$x\text{-DIRECTION: } 0.2309 \omega_A = 1.386 \Rightarrow \boxed{\omega_A = 6.0 \frac{\text{RAD}}{\text{s}} \curvearrowright}$$

PROB. 15-176 CONT.

Y-DIRECTION:  $0.4(6.0) = v_{D/BD} = 2.4 \frac{m}{s}$

$$\vec{v}_{D/BD} = (2.4) \hat{j} \frac{m}{s}$$



$$\vec{a}_D = \vec{a}_{D'} + \vec{a}_{D/BD} + \vec{a}_C$$

$$\vec{a}_{D'} = \cancel{\alpha_{BD}} \hat{k} \times \vec{v}_{D'/B} - \omega_{BD}^2 \vec{r}_{D'/B} = -(6)^2 (-0.2309) \hat{j}$$

$$\vec{a}_{D'} = (8.312) \hat{j} \frac{m}{s^2}$$

$$\vec{a}_D = \alpha_A \hat{k} \times \vec{r}_{D/A} - \omega_A^2 \vec{r}_{D/A}$$

$$\alpha_A \hat{k} \times \vec{r}_{D/A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \alpha_A \\ 0.4 & -0.2309 & 0 \end{vmatrix}$$

$$= [0 - (\alpha_A)(-0.2309)] \hat{i} - [0 - (\alpha_A)(0.4)] \hat{j}$$

$$= (0.2309 \alpha_A) \hat{i} + (0.4 \alpha_A) \hat{j} \frac{m}{s^2}$$

$$-\omega_A^2 \vec{r}_{D/A} = -(6)^2 [(0.4) \hat{i} + (-0.2309) \hat{j}]$$

$$= (-14.4) \hat{i} + (8.312) \hat{j} \frac{m}{s^2}$$

$$\vec{a}_D = (0.2309 \alpha_A - 14.4) \hat{i} + (0.4 \alpha_A + 8.312) \hat{j} \frac{m}{s^2}$$

$$\vec{a}_{D/BD} = (a_{D/BD}) \hat{j}$$

PROB. 15-176 CONT.

$$\vec{a}_C = 2W_{BD} \hat{k} \times \vec{V}_{D/BD} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 12 \\ 0 & 2.4 & 0 \end{vmatrix} = [0 - (12)(2.4)] \hat{i}$$

$$\vec{a}_C = (-28.8) \hat{i}$$

$$(0.2309 \alpha_A - 14.4) \hat{i} + (0.4 \alpha_A + 8.312) \hat{j} = (8.312) \hat{j} + (a_{DBD}) \hat{j} + (-28.8) \hat{i}$$

$$X\text{-DIRECTION: } 0.2309 \alpha_A - 14.4 = -28.8$$

$$\boxed{\alpha_A = -62.36 \frac{\text{RAD}}{\text{s}^2}}$$

$$Y\text{-DIRECTION: } 0.4(-62.36) + (8.312) = 8.312 + a_{DBD}$$

$$a_{DBD} = -24.94 \frac{\text{m}}{\text{s}^2}$$