PROB. 15-135

$\omega_{AB} = 4 \frac{RAD}{s}$ ↺ , $\alpha_{AB} = 2 \frac{RAD}{s^2}$ ↺ , $\omega_{ED} = -6.4 \frac{RAD}{s}$,

$\omega_{BD} = -5.2 \frac{RAD}{s}$ ↻ FIND α_{BD}, α_{DE}

ACCELERATION

$$\vec{a}_B = \vec{a}_A^{\,0} + \alpha_{AB}\hat{k} \times \vec{r}_{B/A} - \omega_{AB}^2 \vec{r}_{B/A}$$

$$\alpha_{AB}\hat{k} \times \vec{r}_{B/A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -2 \\ -0.4 & -0.8 & 0 \end{vmatrix}$$

$$= [0 - (-2)(-0.8)]\hat{i} - [0 - (-2)(-0.4)]\hat{j}$$

$$= (-1.6)\hat{i} + (0.8)\hat{j} \ \frac{m}{s^2}$$

$$-\omega_{AB}^2 \vec{r}_{B/A} = -(-4)^2[(-0.4)\hat{i} + (-0.8)\hat{j}]$$

$$= (6.4)\hat{i} + (12.8)\hat{j}$$

$$\vec{a}_B = (-1.6)\hat{i} + (0.8)\hat{j} + (6.4)\hat{i} + (12.8)\hat{j}$$

$$\vec{a}_B = (4.8)\hat{i} + (13.6)\hat{j} \ \frac{m}{s^2}$$

$$\vec{a}_D = \vec{a}_B + \alpha_{BD}\hat{k} \times \vec{r}_{D/B} - \omega_{BD}^2 \vec{r}_{D/B}$$

$$\alpha_{BD}\hat{k} \times \vec{r}_{D/B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \alpha_{BD} \\ 0.8 & 0 & 0 \end{vmatrix} = -[0 - (\alpha_{BD})(0.8)]\hat{j}$$

$$= (0.8\,\alpha_{BD})\hat{j} \ \frac{m}{s^2}$$

PROB. 15-135 CONT.

$$-\omega_{BD}^2 \vec{r}_{D/B} = -(-5.2)^2(0.8)\hat{i} = (-21.63)\hat{i} \ \frac{m}{s^2}$$

$$\vec{a}_D = (4.8)\hat{i} + (13.6)\hat{j} + (0.8\alpha_{BD})\hat{j} + (-21.63)\hat{i}$$

$$\vec{a}_D = (-16.83)\hat{i} + (13.6 + 0.8\alpha_{BD})\hat{j} \ \frac{m}{s^2}$$

$$\vec{a}_D = \vec{a}_E + \alpha_{DE}\hat{k} \times \vec{r}_{D/E} - \omega_{DE}^2 \vec{r}_{D/E}$$

$$\alpha_{DE}\hat{k} \times \vec{r}_{D/E} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \alpha_{DE} \\ 0.4 & -0.5 & 0 \end{vmatrix}$$

$$= [0 - (\alpha_{DE})(-0.5)]\hat{i} - [0 - (\alpha_{DE})(0.4)]\hat{j}$$

$$= (0.5\alpha_{DE})\hat{i} + (0.4\alpha_{DE})\hat{j} \ \frac{m}{s^2}$$

$$-\omega_{DE}^2 \vec{r}_{D/E} = -(-6.4)^2[(0.4)\hat{i} + (-0.5)\hat{j}]$$

$$= (-16.38)\hat{i} + (20.48)\hat{j} \ \frac{m}{s^2}$$

$$\vec{a}_D = (0.5\alpha_{DE})\hat{i} + (0.4\alpha_{DE})\hat{j} + (-16.38)\hat{i} + (20.48)\hat{j}$$

$$\vec{a}_D = (0.5\alpha_{DE} - 16.38)\hat{i} + (0.4\alpha_{DE} + 20.48)\hat{j}$$

$$(-16.83)\hat{i} + (13.6 + 0.8\alpha_{BD})\hat{j} = (0.5\alpha_{DE} - 16.38)\hat{i} + (0.4\alpha_{DE} + 20.48)\hat{j}$$

X-DIRECTION: $-1683 = 0.5\alpha_{DE} - 16.38 \Rightarrow$ **$\alpha_{DE} = -0.9 \ \frac{RAD}{s^2}$ ↻**

Y-DIRECTION: $13.6 + 0.8\alpha_{BD} = 0.4(-0.9) + 20.48$

$\alpha_{BD} = 8.15 \ \frac{RAD}{s^2}$ ↺