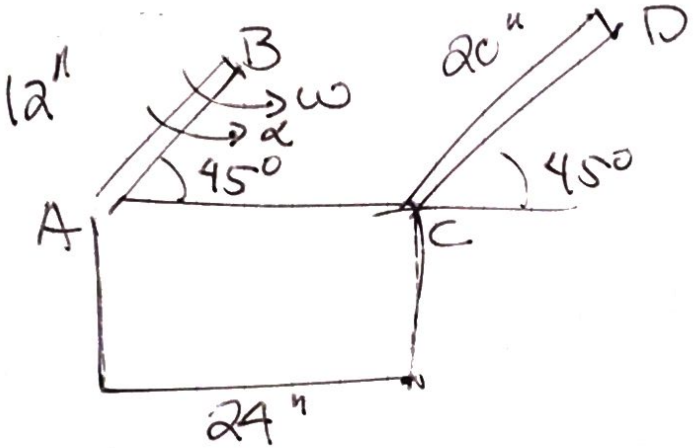
Given



$\omega = 2\ rad/s$

$\alpha = 10\ rad/s^2$

Req'd ω_{AC}, α_{AC}

Estimate → tough - I'm going to check velocity components as I go.

Strategy $\bar{v}_{A/0} = \bar{v}_{B/0} + \bar{\omega}_{AB} \times \bar{r}_{A/B}$

$\bar{a}_{A/0} = \bar{a}_{B/0} + \bar{\alpha}_{AB} \times \bar{r}_{A/B} - \omega^2 \bar{r}_{A/B}$

AB $\bar{v}_{A/0} = \underbrace{v_{B/0}}_{\to 0} + \omega_{AB} \times \bar{r}_{A/B}$

$r_{A/B} = (-8.5\hat{i} - 8.5\hat{j})\ (12\cos 45° !)$

$$v_{A/0} = \begin{vmatrix} i & j & k \\ 0 & 0 & 2 \\ -8.5 & -8.5 & 0 \end{vmatrix} = \underline{17\hat{i} - 17\hat{j}}$$

$\bar{a}_{A/0} = \underbrace{\bar{a}_{B/0}}_{\to 0} + \bar{\alpha}_{AB} \times \bar{r}_{A/B} - \omega^2_{AB} \bar{r}_{A/B}$

$$\begin{vmatrix} i & j & k \\ 0 & 0 & 10 \\ -8.5 & -8.5 & 0 \end{vmatrix} = 85\hat{i} - 85\hat{j}$$

$\omega^2 r_{A/B} = 4(-8.5\hat{i} - 8.5\hat{j})$

$= 34\hat{i} + 34\hat{j}$

$\bar{a}_{A/0} = (85\hat{i} - 85\hat{j}) + (34\hat{i} + 34\hat{j})$

$= 119\hat{i} - 51\hat{j}$

1 SQUARE =

7

AC $\xleftrightarrow{\text{both are constrained}}$ CD

$V_{C/O} = V_{A/O} + \bar{\omega}_{AC} \times \bar{r}_{C/A}$

$= (17\hat{i} - 17\hat{j}) +$

$\begin{vmatrix} i & j & k \\ 0 & 0 & \omega_{AC} \\ 24 & 0 & 0 \end{vmatrix} = 24\omega_{AC}\hat{j}$

$V_{C/O} = 17\hat{i} + (-17 + 24\omega_{AC})\hat{j}$

$V_{C/O} = \underbrace{V_{D/O}}_{0} + \bar{\omega}_{CD} \times \bar{r}_{C/D}$

$V_{C/O} = \begin{vmatrix} i & j & k \\ 0 & 0 & \omega_{CD} \\ -14.14 & -14.14 & 0 \end{vmatrix}$

$= 14.14\,\omega_{CD}\hat{i} - 14.14\,\omega_{CD}\hat{j}$

$\Rightarrow 17 = 14.14\,\omega_{CD} \quad \omega_{CD} = 1.2 \text{ rad/s}$

$-17 + 24\,\omega_{AC} = -17 = -14.14\,\omega_{CD}$

$\Rightarrow 24\omega_{AC} = 0 \Rightarrow \boxed{\omega_{AC} = 0}$!!

Same Game w/ $\bar{a}$!

$\bar{a}_{C/O} = \bar{a}_{A/O} + \bar{\alpha}_{AC} \times \bar{r}_{C/A} - \cancel{\omega^2_{AC}}\, r_{C/A}$

$\alpha_{AC} \times r_{C/A} = \begin{vmatrix} i & j & k \\ 0 & 0 & \alpha_{AC} \\ 24 & 0 & 0 \end{vmatrix} = 24\alpha_{AC}\hat{j}$

$a_{C/O} = \underbrace{a_{D/O}}_{0} + \bar{\alpha}_{CD} \times \bar{r}_{C/D} - \omega^2_{CD}\, \bar{r}_{C/D}$

$\alpha_{CD} \times r_{C/D} = \begin{vmatrix} i & j & k \\ 0 & 0 & \alpha_{CD} \\ -14.14 & -14.14 & 0 \end{vmatrix} = 14.14\alpha_{CD}\hat{i} - 14.14\alpha_{CD}\hat{j}$

$\bar{a}_{C/O} = (119\hat{i} - 51\hat{j}) + 24\alpha_{AC}\hat{j}$

$\bar{a}_{C/O} = 119\hat{i} + (24\alpha_{AC} - 51)\hat{j}$

$-\omega_{CD}^2 \bar{r}_{C/D} = -(1.2)^2(-14.14\hat{i} - 14.14\hat{j})$

$= 20.44\hat{i} + 20.44\hat{j}$

$\bar{a}_{C/O} = 14.14\alpha_{CD}\hat{i} - 14.14\alpha_{CD}\hat{j} + 20.44\hat{i} + 20.44\hat{j}$

$= (14.14\alpha_{CD} + 20.44)\hat{i} + (20.44 - 14.14\alpha_{CD})\hat{j}$

$\Rightarrow 119\hat{i} = 14.14\alpha_{CD} + 20.44$

$\Rightarrow \alpha_{CD} = \dfrac{119 - 20.44}{14.14} = 6.97$

then $24\alpha_{AC} - 51 = 20.44 - 14.14(6.97)$

-98.56

$24\alpha_{AC} = -27.12 \Rightarrow \boxed{\alpha_{AC} = -1.13}$!!

Crikey! 4th time it worked!