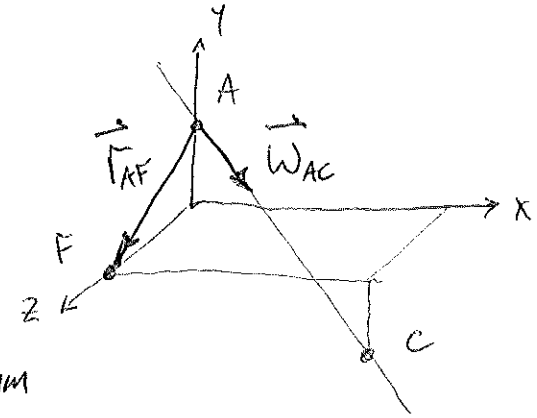
PROB. 15-10

$\omega_{AC} = 9 \frac{RAD}{s}$, FIND $\vec{v}$, $\vec{a}$ FOR CORNER F.

$\vec{v}_F = \vec{\omega} \times \vec{r} = \vec{\omega}_{AC} \times \vec{r}_{AF}$

DEFINE $\vec{\omega}_{AC} = |\vec{\omega}_{AC}| \cdot \vec{\lambda}_{AC}$



$\vec{\lambda}_{AC} = \frac{\vec{AC}}{|\vec{AC}|}$

$dx = x_C - x_A = (350) - (0) = 350^{mm}$

$dy = y_C - y_A = (-100) - (100) = -200^{mm}$

$dz = z_C - z_A = (200) - (0) = 200^{mm}$

$d = \sqrt{350^2 + 200^2 + 200^2} = 450^{mm}$

$\vec{\lambda}_{AC} = \left(\frac{350}{450}\right)\hat{i} + \left(\frac{-200}{450}\right)\hat{j} + \left(\frac{200}{450}\right)\hat{k}$

$\vec{\lambda}_{AC} = (0.7778)\hat{i} + (-0.4444)\hat{j} + (0.4444)\hat{k}$

$\vec{\omega}_{AC} = \left(9 \frac{RAD}{s}\right)\left[(0.7778)\hat{i} + (-0.4444)\hat{j} + (0.4444)\hat{k}\right]$

$\vec{\omega}_{AC} = (7)\hat{i} + (-4)\hat{j} + (4)\hat{k} \ \frac{RAD}{s}$

FIND POSITION VECTOR $\vec{r}_{AF}$

$dx = x_F - x_A = (0) - (0) = 0$

$dy = y_F - y_A = (0) - (100) = -100^{mm}$

$dz = z_F - z_A = (200) - (0) = 200^{mm}$

$\vec{r}_{AF} = (0)\hat{i} + (-100)\hat{j} + (200)\hat{k}^{mm}$

$\vec{r}_{AF} = (0)\hat{i} + (-0.1)\hat{j} + (0.2)\hat{k}^{m}$

PROB. 15-10 CONT.

$$\vec{v}_F = \vec{\omega}_{AC} \times \vec{r}_{AF} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 7 & -4 & 4 \\ 0 & -0.1 & 0.2 \end{vmatrix}$$

$$\vec{v}_F = [(-4)(0.2) - (4)(-0.1)]\hat{i} - [(7)(0.2) - (4)(0)]\hat{j} + [(7)(-0.1) - (-4)(0)]\hat{k} \ \frac{m}{s}$$

$$\boxed{\vec{v}_F = (-0.4)\hat{i} + (-1.4)\hat{j} + (-0.7)\hat{k} \ \frac{m}{s}}$$

$$\vec{a} = \vec{\alpha} \times \vec{r} + \vec{\omega} \times (\vec{\omega} \times \vec{r}) \ ; \ \vec{\alpha} = 0, \ \vec{\omega} \times \vec{r} = \vec{v}$$

$$\vec{a}_F = \vec{\omega} \times \vec{v} = \vec{\omega}_{AC} \times \vec{v}_F$$

$$\vec{a}_F = \vec{\omega}_{AC} \times \vec{v}_F = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 7 & -4 & 4 \\ -0.4 & -1.4 & -0.7 \end{vmatrix}$$

$$\vec{a}_F = [(-4)(-0.7) - (4)(-1.4)]\hat{i} - [(7)(-0.7) - (4)(-0.4)]\hat{j} + [(7)(-1.4) - (-4)(-0.4)]\hat{k} \ \frac{m}{s^2}$$

$$\boxed{\vec{a}_F = (8.4)\hat{i} + (3.3)\hat{j} + (-11.4)\hat{k} \ \frac{m}{s^2}}$$