Kinematic Equations

$$\mathbf{v}_P = \mathbf{v}_A + \mathbf{\Omega} \times \mathbf{r}_{P/A} + (\mathbf{v}_{P/A})_{xyz}$$

$$\mathbf{a}_P = \mathbf{a}_A + \dot{\mathbf{\Omega}} \times \mathbf{r}_{P/A} + \mathbf{\Omega} \times (\mathbf{\Omega} \times \mathbf{r}_{P/A}) + 2\mathbf{\Omega} \times (\mathbf{v}_{P/A})_{xyz} + (\mathbf{a}_{P/A})_{xyz}$$

Motion of Moving Reference	Motion of P with respect to moving reference
$\mathbf{v}_A = 0$	$\mathbf{r}_{P/A} = \sqrt{1.25^2 + 2.25^2 - 2(1.25)(2.5)\cos(180-\theta)}\ \mathbf{i}$
$\mathbf{a}_A = 0$	$(\mathbf{v}_{P/A})_{xyz} = (v_{P/A})_{xyz}\ \mathbf{i}$
$\mathbf{\Omega} = \omega_{AE}\mathbf{k}$	$(\mathbf{a}_{P/A})_{xyz} = (a_{P/A})_{xyz}\ \mathbf{i}$
$\dot{\mathbf{\Omega}} = \alpha_{AE}\mathbf{k}$	

Motion of slider block P

$\mathbf{r}_{P/B} = (1.25\cos\theta\boldsymbol{i} + 1.25\sin\theta\mathbf{j})$

$\mathbf{v}_p = \boldsymbol{\omega}_{BP} \times \mathbf{r}_{P/B} = (6\boldsymbol{k}) \times (1.25\cos\theta\,\boldsymbol{i} + 1.25\sin\theta\,\boldsymbol{j}) = (-7.5\sin\theta\,\boldsymbol{i} + 7.5\cos\theta\,\boldsymbol{j})$

$\boldsymbol{\alpha}_{BP} = 0$ (constant $\boldsymbol{\omega}_{BP}$)

$\mathbf{a}_P = \boldsymbol{\alpha}_{BP} \times \mathbf{r}_{P/B} - (\omega^2_{BP})(\mathbf{r}_{P/A})$

$\mathbf{a}_P = 0\mathbf{k} \times (1.25\cos\theta\,\boldsymbol{i} + 1.25\sin\theta\,\boldsymbol{j}) - 6^2(1.25\cos\theta\,\boldsymbol{i} + 1.25\sin\theta\,\boldsymbol{j})$

$\mathbf{a}_P = (-45\cos\theta\,\boldsymbol{i} - 45\sin\theta\,\boldsymbol{j})$

Solving for $(v_{P/A})_{xyz}$ and ω_{AE}

$\mathbf{v}_P = \mathbf{v}_A + \Omega \times \mathbf{r}_{P/A} + (\mathbf{v}_{P/A})_{xyz}$

$(-7.5\sin\theta\,\boldsymbol{i} + 7.5\cos\theta\,\boldsymbol{j}) = 0 + \omega_{AE}\mathbf{k} \times \sqrt{1.25^2 + 2.25^2 - 2(1.25)(2.5)\cos(180-\theta)}\mathbf{i} + (v_{P/A})_{xyz}\ \mathbf{i}$

$(-7.5\sin\theta\,\boldsymbol{i} + 7.5\cos\theta\,\boldsymbol{j}) = \omega_{AE}\sqrt{1.25^2 + 2.25^2 - 2(1.25)(2.5)\cos(180-\theta)}\mathbf{j} + (v_{P/A})_{xyz}\ \mathbf{i}$

$(v_{P/A})_{xyz} = -7.5\sin\theta$

$\omega_{AE} = (7.5\cos\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}$ counterclockwise

Solving for $(a_{P/A})_{xyz}$ and α_{AE}

$\mathbf{a}_P = \mathbf{a}_A + \dot{\mathbf{\Omega}} \times \mathbf{r}_{P/A} + \mathbf{\Omega} \times (\mathbf{\Omega} \times \mathbf{r}_{P/A}) + 2\mathbf{\Omega} \times (\mathbf{v}_{P/A})_{xyz} + (\mathbf{a}_{P/A})_{xyz}$

$$(-45\cos\theta\,\boldsymbol{i} - 45\sin\theta\,\boldsymbol{j}) = 0 + \alpha_{AE}\mathbf{k} \times \sqrt{7.8125 - 6.25\cos(180-\theta)}\,\mathbf{i}\ +$$

$$[(7.5\cos\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}\ ]\mathbf{k} \times$$

$$[(7.5\cos\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}\mathbf{k} \times \sqrt{7.8125 - 6.25\cos(180-\theta)}\,\mathbf{i}\ ]$$

$$+2\ [(7.5\cos\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}\mathbf{k} \times -7.5\sin\theta\,\mathbf{i} + (a_{P/A})_{xyz}\mathbf{i}$$

$$(-45\cos\theta\,\boldsymbol{i} - 45\sin\theta\,\boldsymbol{j}) = \alpha_{AE}\sqrt{7.8125 - 6.25\cos(180-\theta)}\,\mathbf{j}$$

$$-\ (56.25\ (\cos\theta)\text{^}2/\sqrt{7.8125 - 6.25\cos(180-\theta)}\,\mathbf{i}$$

$$-\ (112.5\cos\theta\sin\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}\mathbf{j}\ + (a_{P/A})_{xyz}\mathbf{i}$$

$$(a_{P/A})_{xyz} = (56.25\ (\cos\theta)\text{^}2/\sqrt{7.8125 - 6.25\cos(180-\theta)} - 45\cos\theta$$

$$\alpha_{AE} = [(-45\sin\theta)/\sqrt{7.8125 - 6.25\cos(180-\theta)}\ ]\ +\ [(112.5\cos\theta\sin\theta)/(7.8125 - 6.25\cos(180-\theta))]$$