

# Bottom Loop

Friday, March 31, 2017 9:54 PM

## Velocities:

$$X: 0 + (-W_5)R_5 \sin \theta_5 + (-W_4)R_4 \sin \theta_4 - R_x' - 0 = 0$$

$$Y: 0 + W_5 R_5 \cos \theta_5 + W_4 R_4 \cos \theta_4 - 0 - 0 = 0$$

Unknowns:  $W_5, W_4, R_x'$

## Accelerations:

$$X: 0 + [-\alpha_5 R_5 \sin \theta_5 - W_5^2 R_5 \cos \theta_5] + [-\alpha_4 R_4 \sin \theta_4 - W_4^2 R_4 \cos \theta_4] - R_x'' = 0$$

$$Y: 0 + [\alpha_5 R_5 \cos \theta_5 - W_5^2 R_5 \sin \theta_5] + [\alpha_4 R_4 \cos \theta_4 - W_4^2 R_4 \sin \theta_4] - 0 = 0$$

Unknowns:  $\alpha_5, \alpha_4, R_x''$

## COMBINED LOOP EQUATIONS:

Position: unknowns:  $X(1) = l_{AC}, X(2) = \theta_4, X(3) = \theta_5, X(4) = R_x$

$$(1) l_{A0A} \cos \theta_2 + X(1) \cdot \cos(X(2)) + X(4) [= 0]$$

$$(2) l_{A0A} \sin \theta_2 + X(1) \cdot \sin(X(2)) - R_y [= 0]$$

$$(3) R_5 \cos(X(3)) + R_4 \cdot \cos(X(2)) + X(4) [= 0]$$

$$(4) -R_0 + R_5 \sin(X(3)) + R_4 \sin(X(2)) - R_y [= 0]$$

Solve using  
fsolve in  
MATLAB

## Velocities:

unknowns:  $l_{AC}', W_4, W_5, R_x'$

$$(1) l_{AC}' [\cos \theta_4] + W_4 [l_{AC} (-\sin \theta_4)] + W_5 [0] + R_x' [+1] = l_{A0A} W_2 (\sin \theta_2)$$

$$(2) l_{AC}' [\sin \theta_4] + W_4 [l_{AC} (\cos \theta_4)] + W_5 [0] + R_x' [0] = -l_{A0A} W_2 (\cos \theta_2)$$

$$(3) l_{AC}' [0] + W_4 [-R_4 (\sin \theta_4)] + W_5 [-R_5 \sin \theta_5] + R_x' [+1] = 0$$

$$(4) l_{AC}' [0] + W_4 [R_4 (\cos \theta_4)] + W_5 [R_5 \cos \theta_5] + R_x' [0] = 0$$

\* solve using matrices in  
MATLAB