Robotics

(ICT - 3311)

Assignment 01

coordinate Transformation

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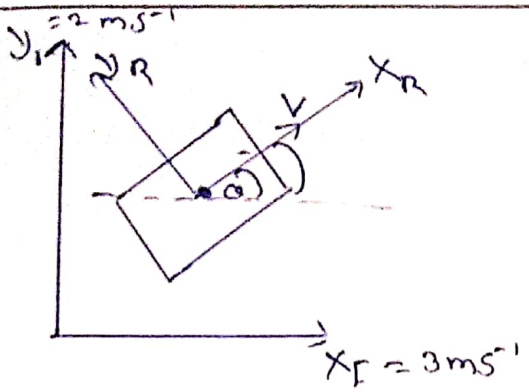
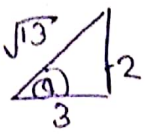
① (a)





$\theta = \tan^{-1}(2/3)$

$\theta = 33.7°$

$\cos\theta = \frac{3}{\sqrt{13}}$ $\quad \sin\theta = \frac{2}{\sqrt{13}}$

$\cos\theta = 0.832$ $\quad = 0.555$

$y_R = 0$

$\xi_I = R(\theta)\,\xi_R$

$$\xi_I = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_I \\ y_I \\ \theta_I \end{bmatrix}$$

$$= \begin{bmatrix} 0.832 & 0.555 & 0 & 3 \\ -0.555 & 0.832 & 0 & 2 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

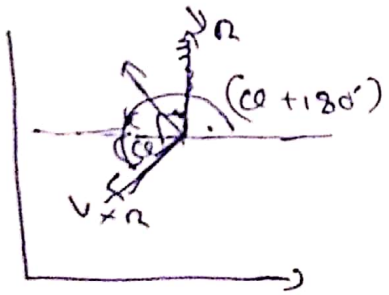
$x_R = 0.832 \times 3 + 0.555 \times 2$

$x_R = 3.66\,ms^{-1}$ //

$y_R = -0.555 \times 3 + 0.832 \times 2 \approx 0$

$y_R = 0$ //

(b)



when opposite

$\theta = (180° + \theta')$

$\xi_I = R(\theta)\,\xi_R$

(1) (b)
$$\begin{bmatrix} \cos(180^\circ+\theta) & \sin\theta(180^\circ+\theta) & 0 \\ -\sin(180^\circ+\theta) & \sin(180^\circ+\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$$

$\cos(180^\circ+\theta) = -\cos\theta$
$\sin(180^\circ+\theta) = -\sin\theta$

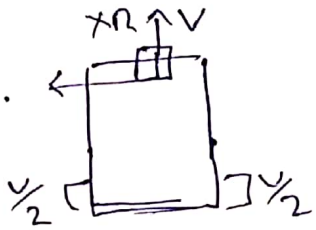
$V_{xR} = (-8.32 \times 3) + (-0.555 \times 2)$

~~$V_{yR} = 0$~~

$V_{xR} = -3.61\ ms^{-1}$ //

$V_{yR} = 0$

(c)



V = pure rolling
no sliding

$V/2 = r\omega_R$

$x_R = 2r\omega_R$

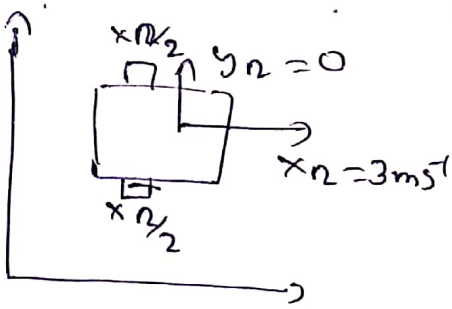
$x_R = 2r\omega_l$

$\omega_l = \frac{x_R}{2r}$

$l = 3 \times 10^{-2}\ m$

$x_R = 3\ ms^{-1}$

& $r = 1.5$



$\omega_l = \frac{3}{2 \times 1.5 \times 10^{-2}}\ rads^{-1}$

$\omega_l = 100\ rads^{-1}$ //