

## Differential Drive

Wheel to wheel distance ( $d$ ) = 0.15 m

Wheel radius ( $r$ ) = 0.03 m

1. a)  $v_x = 5 \text{ cm/s}$ ;  $\omega_z = 0.1 \text{ rad/s}$

$$v_L = v_x - \frac{d}{2} \omega_z$$

$$v_R = v_x + \frac{d}{2} \omega_z$$

$$v_L = 0.05 - \frac{0.15 \times 0.1}{2} = 0.0575 \text{ m/s}$$

$$v_R = 0.05 + \frac{0.15 \times 0.1}{2} = 0.0575 \text{ m/s}$$

$$\omega_R = \frac{0.0575}{0.03} = 1.9167 \text{ rad/s}$$

$$\omega_L = \frac{0.0425}{0.03} = 1.4167 \text{ rad/s}$$

b)  $v_x = -1.5 \text{ cm/s}$ ,  $\omega_z = 0.2 \text{ rad/s}$

$$v_R = -0.015 + \frac{0.15 \times 0.2}{2} = 0 \text{ m/s}$$

$$v_L = -\frac{0.015}{2} - \frac{0.15 \times 0.2}{2} = -0.03 \text{ m/s}$$

$$\omega_R = 0 \text{ rad/s}$$

$$\omega_L = -1 \text{ rad/s}$$

2. Move in circle of  $R = 50\text{cm} = 0.5\text{m}$  in  $70\text{s}$

$$\text{Circumference } C = 2\pi R = 2\pi \times 0.5 = 3.14 \text{ m}$$

$$v_n = \frac{C}{T} = \frac{3.14}{70} = 0.045 \text{ m/s}$$

$$\omega_2 = \frac{v_n}{R} = \frac{0.045}{0.5} = 0.09 \text{ rad/s}$$

$$v_R = 0.045 + \frac{\cancel{0.5}}{2} \frac{0.15 \times 0.09}{2} = \cancel{0.5175} \text{ m/s}$$

$$v_L = 0.045 - 0.075 \times 0.09 = \cancel{0.3825} \text{ m/s}$$

$$\omega_R = \frac{0.05175}{0.03} = 1.725 \text{ rad/s}$$

$$\omega_L = \frac{0.03825}{0.03} = 1.275 \text{ rad/s}$$