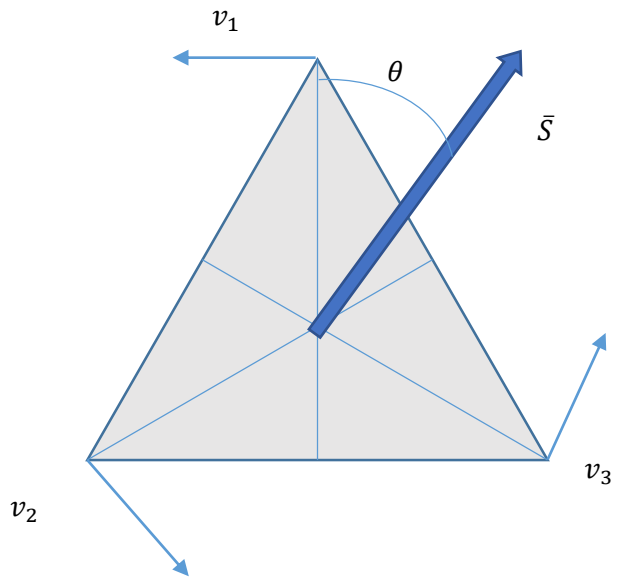
3-Wheel Omnidirectional drive Motor Calculations



here:
$S = Movement\ Speed$
$\theta = heading$
v_1, v_2, v_3 *respectively represent the velocities or power to respective motors* M_1, M_2, M_3

$$S\begin{pmatrix} sin\theta \\ cos\theta \end{pmatrix} = v_1 e^{-i\pi} + v_2 e^{-\frac{i\pi}{3}} + v_3 e^{\frac{i\pi}{3}}$$

$$S\begin{pmatrix} sin\theta \\ cos\theta \end{pmatrix} = v_1\begin{pmatrix} -1 \\ 0 \end{pmatrix} + v_2\begin{pmatrix} \frac{1}{2} \\ \frac{-\sqrt{3}}{2} \end{pmatrix} + v_3\begin{pmatrix} \frac{1}{2} \\ \frac{\sqrt{3}}{2} \end{pmatrix}$$

$And\ we\ have\ to\ minimise\ C = \sqrt{v_1^2 + v_2^2 + v_3^2}\ \ or\ effectively\ C^2 = v_1^2 + v_2^2 + v_3^2$

$$v_2 = v_1 + S\ sin\theta - S\frac{cos\theta}{\sqrt{3}}$$

$$v_3 = v_1 + S\ sin\theta + S\frac{cos\theta}{\sqrt{3}}$$

$$\therefore C^2 = v_1^2 + \left(v_1 + S\ sin\theta - S\frac{cos\theta}{\sqrt{3}}\right)^2 + \left(v_1 + S\ sin\theta + S\frac{cos\theta}{\sqrt{3}}\right)^2$$

$Taking\ derivative\ wrt\ v_1$

$$\frac{\partial C^2}{\partial v_1} = 2v_1 + 2\left(v_1 + S\,sin\theta - S\frac{cos\theta}{\sqrt{3}}\right) + 2\left(v_1 + S\,sin\theta + S\frac{cos\theta}{\sqrt{3}}\right) = 0$$

$$\Rightarrow 6v_1 + 4S\,sin\theta = 0$$

$$\Rightarrow v_1 = S\left(\frac{-2sin\theta}{3}\right)$$

$$\Rightarrow v_2 = S\left(\frac{sin\theta}{3} - \frac{cos\theta}{\sqrt{3}}\right)$$

$$\Rightarrow v_3 = S\left(\frac{sin\theta}{3} + \frac{cos\theta}{\sqrt{3}}\right)$$

Calculation on uC

Calculate constants

$$A = \frac{sin\theta}{3} \quad \& \quad B = \frac{cos\theta}{\sqrt{3}}$$

$$\boldsymbol{v_1 = S\,(-2A\,)}$$

$$\boldsymbol{v_2 = S\,(A - B)}$$

$$\boldsymbol{v_3 = S\,(A + B)}$$