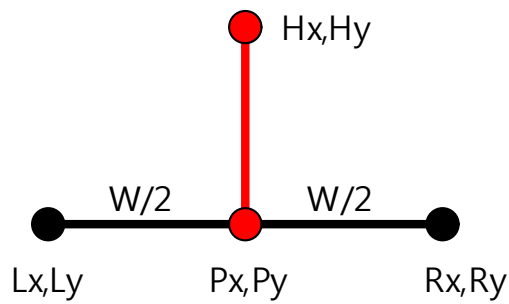


Motion Calc



$$Q = \text{ArcTan}[Hx - Px, Hy - Py];$$

$$Lx = Px + W / 2 * \cos[Q + \text{Pi} / 2];$$

$$Ly = Py + W / 2 * \sin[Q + \text{Pi} / 2];$$

$$Rx = Px + W / 2 * \cos[Q - \text{Pi} / 2];$$

$$Ry = Py + W / 2 * \sin[Q - \text{Pi} / 2];$$

$$Odo = (L + R) / 2;$$

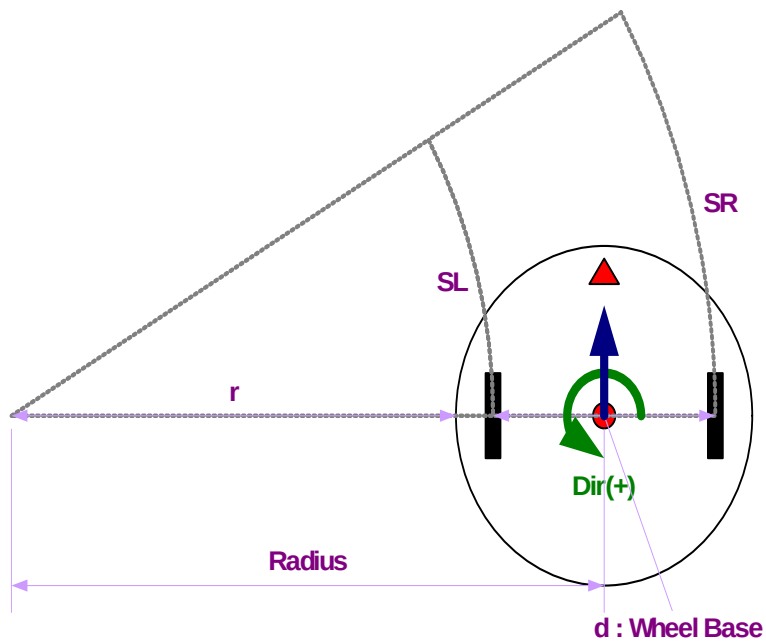
$$\text{Gonio} = (R - L) / W;$$

$$2 * Odo = L + R;$$

$$\text{Gonio} = 2 * (Odo - L) / W;$$

$$\text{Gonio} = 2 * (R - Odo) / W;$$

Motion Control



Radius = LinearVelocity / AngularVelocity

Goniometer = AngVel * Timer = (SR - SL) / 2

Odometer = LinVel * Timer = (SL + SR) / 2

SL = r * Gonio = (LinVel - d/2 * AngVel) * t

SR = (r + d) * Gonio = (LinVel + d/2 * AngVel) * t

SR - SL = d * Gonio = (d * AngVel) * t

Odo = (SL + SR) / 2 = (r + d/2) * Gonio = LinVel * t

Gonio = (SR - SL) / d = AngVel * t

Radius = r + d/2 = LinVel / AngVel

Velocity

Dir = +1 (Left) or -1 (Right)

AngVel = Dir * DEG2RAD (Degree)

LinVel = Dir * Radius * AngVel

AngVel = Dir * LinVel / Radius

■ Summary

SL : Left Wheel Distance

SR : Right Wheel Distance

Dir : Direction

d : Wheel_Base

r : Radius of Rotation

R : Radius = $r + \frac{d}{2}$

LinVel : Linear Velocity

AngVel : Angular Velocity

t : Timer

Gonio : Goniometer = AngVel * t

Odo : Odometer = LinVel * t = $\frac{SL + SR}{2}$

Radius = $\frac{LinVel}{AngVel}$

$r = \frac{LinVel}{AngVel} - \frac{d}{2}$

■ Velocity

SL = $\left(LinVel - \frac{d}{2} * AngVel \right) * t = r * Gonio$

SR = $\left(LinVel + \frac{d}{2} * AngVel \right) * t = (r + d) * Gonio$

SR - SL = d * Gonio = (d * AngVel) * t

$$\text{Odo} = \frac{\text{SL} + \text{SR}}{2} = \frac{r + d}{2} * \text{Gonio} = \text{LinVel} * t$$

$$\text{Gonio} = \frac{\text{SR} - \text{SL}}{d} = \text{AngVel} * t$$

$$\text{Radius} = r + \frac{d}{2} = \frac{\text{LinVel} * t}{\text{Gonio}} = \frac{\text{LinVel}}{\text{AngVel}}$$

Dir = +1 (Left) or -1 (Right);

AngVel = Dir * Deg2Rad (Degree);

LinVel = Dir * Radius * AngVel;

AngVel = Dir * LinVel / Radius; (Not Radians Just LinVel / Radius)

■ How To

$$Q = \text{ArcTan}[ax - bx, ay - by];$$

$$R = \sqrt{(bx - ax)^2 + (by - ay)^2} = (bx - ax) \cos[Q] + (by - ay) \sin[Q];$$

$$ax = bx + R \cos[Q];$$

$$ay = by + R \sin[Q];$$

$$\begin{pmatrix} ax \\ ay \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & R \cos[Q] \\ 0 & 1 & R \sin[Q] \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} bx \\ by \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} ax \\ ay \\ 1 \end{pmatrix} = \begin{pmatrix} \cos[Q] & -\sin[Q] & bx \\ \sin[Q] & \cos[Q] & by \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} R \\ 0 \\ 1 \end{pmatrix}$$

$$\text{Inverse} \left[\begin{pmatrix} \cos[Q] & -\sin[Q] & bx \\ \sin[Q] & \cos[Q] & by \\ 0 & 0 & 1 \end{pmatrix} \right]$$

$$\begin{pmatrix} R \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} (ax - bx) \cos[Q] + (ay - by) \sin[Q] \\ (ay - by) \cos[Q] - (ax - bx) \sin[Q] \\ 1 \end{pmatrix}$$

$$R = \cos[Q] * (ax - bx) + \sin[Q] * (ay - by);$$

$$0 = -\sin[Q] * (ax - bx) + \cos[Q] * (ay - by);$$

$$\sin[Q] * (ax - bx) = \cos[Q] * (ay - by);$$

$$\tan[Q] = \frac{\sin[Q]}{\cos[Q]} = \frac{ay - by}{ax - bx};$$

$$Q = \text{ArcTan} \left[\frac{ay - by}{ax - bx} \right];$$

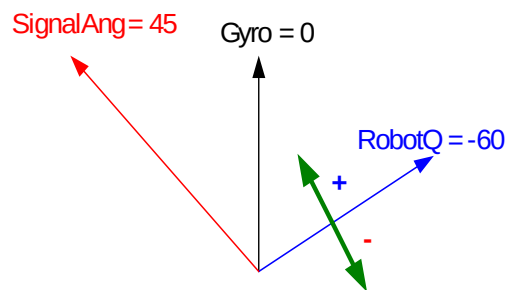
$$\frac{x - ax}{bx - ax} = \frac{y - ay}{by - ay}$$

$$y = \frac{by - ay}{bx - ax} (x - ax) + ay;$$

$$y = \tan[Q] (x - ax) + ay;$$

$$\text{Det} \left[\begin{pmatrix} ax & ay & 1 \\ bx & by & 1 \\ cx & cy & 1 \end{pmatrix} \right] = ax * (by - cy) + bx * (cy - ay) + cx * (ay - by)$$

SignalAng - RobotQ - Turn - Motion - Gonio



■ Setting

Setting

MotionDir	MotionQ = SignalAng - RobotQ	
+	< +0.5	MotionQ += 360
-	> -0.5	MotionQ -= 360
MotionDir	MotionQ = SignalAng - RobotQ	
+ (L)	< +0.5	MotionQ += 360
- (R)	> -0.5	MotionQ -= 360

■ Arrive Angle

Arrive

MotionDir	Gonio += DiffQ
+	Gonio > MotionQ
-	Gonio < MotionQ
	Abs(Gonio) > 360

```

MotionDir  Gonio += DiffQ
+ (L)      Gonio > MotionQ
- (R)      Gonio < MotionQ
           Abs[Gonio] > 360

```

