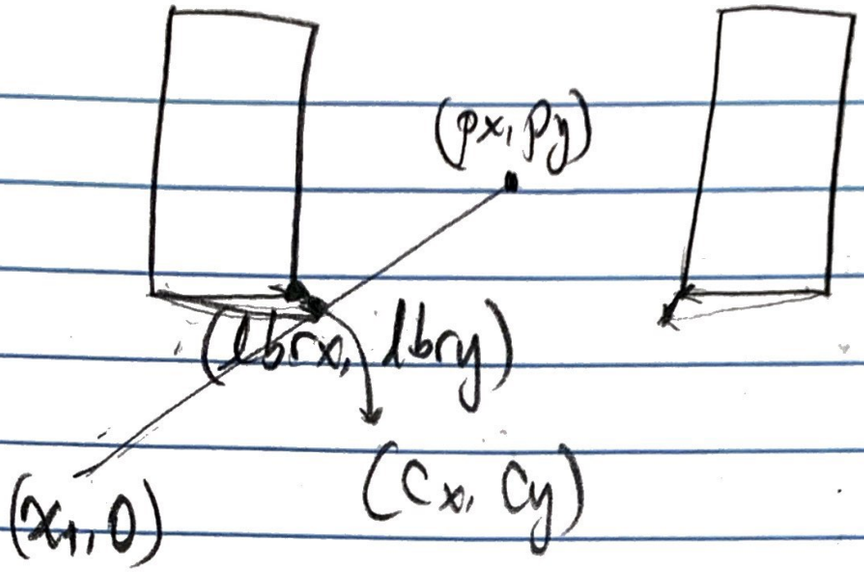

$$m = \frac{p_y}{p_x - x_1} \qquad y = m(x - x_1)$$

$$y = \frac{p_y}{p_x - x_1}(x - x_1)$$

$$(c_x, c_y) = (c_x,\ m\ (c_x - x_1))$$

$$y' = -\frac{(x - lbrx)}{y - lbry}$$

$$y' = m = -\frac{(c_x - lbrx)}{m(c_x - x_1) - lbry}$$

$$m^2(c_x - x_1) - m\ lbry = -c_x + lbrx$$

$$c_x(m^2 + 1) = m\ lbry + lbrx + m^2 x_1$$

$$c_x = \frac{m\ lbry + lbrx + m^2 x_1}{m^2 + 1}$$

Define gap:

if $P_y > lbry$:

$C_x > lbrx$? $sgninner = 1$: $sgninner = -1$

$g_{1 innerleft} = \left((C_x - lbrx)^2 + (C_y - lbry)^2 \right)^{1/2}$

$C_x > lbrx + t$

$g_{1 outerleft} = -\| [C_x, C_y] - [lbrx, lbry] + [t, 0] \|$

$g_{2 innerleft} = P_x - d$

$g_{2 outerleft} = -g_{2 innerleft}$

else

$g_{1 innerleft}, g_{2 innerleft} = \| [P_x, P_y] - [lbrx, lbry] \|$

$g_{1 outerleft}, g_{2 outerleft} = -g_{1 innerleft} - t$

end

Repeat for right wall

Define time derivative of gap:

if $p_y > lbry$:

$$\dot{\gamma}_{1,\text{innerleft}} = \frac{1}{2\,g_{1,\text{innerleft}}} \left(2(C_x - lbrx)\dot{C}_x + 2(C_y - lbry)\dot{C}_y\right)$$

$$= \frac{1}{g_{1,\text{innerleft}}} \left[(C_x - lbrx)\dot{C}_x + (C_y - lbry)\dot{C}_y\right]$$

$$\dot{C}_x = A\dot{\theta} + B\dot{x}, \text{ where}$$

$$A = \sec^2(\theta)\left[lbry\tan^2(\theta) - lbry + 2\,lbrx\tan(\theta) - 2x_1\tan(\theta)\right] \cdot \frac{1}{(\tan^2(\theta)+1)^2}$$

$$B = \frac{1}{\tan^2(\theta)+1}$$

$$\dot{C}_y = \frac{-(A\dot{\theta} + B\dot{x}_1)}{\tan(\theta)} - \frac{(x_1 - C_x)}{\sin^2(\theta)}\dot{\theta} + \frac{1}{\tan(\theta)}\dot{x}_1$$

$$= \underbrace{\left[\frac{-A}{\tan(\theta)} - \frac{(x_1 - C_x)}{\sin^2(\theta)}\right]}_{D}\dot{\theta} + \underbrace{\left[\frac{-B+1}{\tan(\theta)}\right]}_{E}\dot{x}_1$$

$$\dot{r}_{innerleft} = \frac{1}{g_{innerleft}}\left[(C_x - l_{brx})\left[(-A)\dot{\theta} + B\dot{x}_1\right] + (C_y - l_{bry})(D\dot{\theta} + E\dot{x}_1)\right]$$

$$= \frac{1}{g_{innerleft}}\begin{bmatrix} (C_x - l_{brx})B + (C_y - l_{bry})E \\ (C_x - l_{brx})(A) + (C_y - l_{bry})D \end{bmatrix}^T \begin{matrix} \\ V \end{matrix}$$

$\downarrow$ sg_{inner}