

## 1 XY control

$$\begin{aligned}\ddot{x} &= K * (\sin(x_1) * \sin(yaw) + \cos(x_1) * \sin(x_2) * \cos(yaw)) \\ \ddot{y} &= K * (-\cos(yaw) * \sin(x_1) + \cos(x_1) * \sin(x_2) * \sin(yaw))\end{aligned}$$

Multiplying line 1 with  $\cos(yaw)$  and line 2  $\sin(yaw)$

$$\begin{aligned}\sin(yaw) * \ddot{x} - \cos(yaw) * \ddot{y} &= K * (\sin(x_1)) \\ \cos(yaw) * \ddot{x} + \sin(yaw) * \ddot{y} &= K * (\cos(x_1) * \sin(x_2))\end{aligned}$$

$$\begin{aligned}roll &= \arcsin\left(\frac{\sin(yaw) * \ddot{x} - \cos(yaw) * \ddot{y}}{K}\right) \\ pitch &= \arcsin\left(\frac{\cos(yaw) * \ddot{x} + \sin(yaw) * \ddot{y}}{K * \cos(roll)}\right)\end{aligned}$$

$$\begin{aligned}roll &= \arcsin(-u_y) \\ pitch &= \arcsin\left(\frac{u_x}{\cos(yaw)}\right)\end{aligned}$$