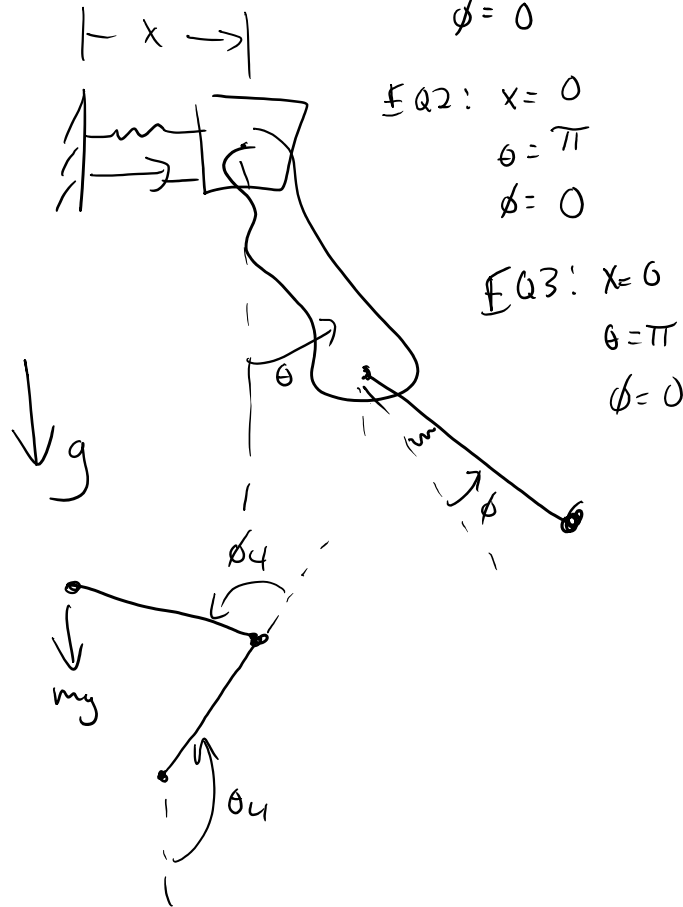
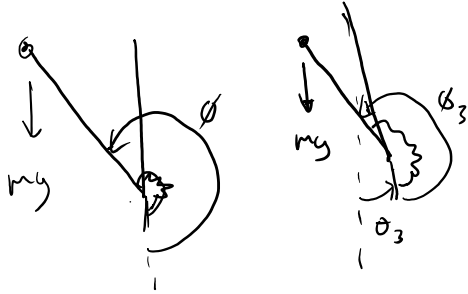


Linearization

1. linear models are simpler
2. control design (classic linear control)
3. reasonable models of the world. (but limited)

Equil ($u = \dot{u} = 0$)
stable and unstable



$$\text{EQ1: } \begin{aligned} x &= 0 \\ \theta &= 0 \\ \phi &= 0 \end{aligned}$$

$$\text{EQ2: } \begin{aligned} x &= 0 \\ \theta &= \pi \\ \phi &= 0 \end{aligned}$$

$$\text{EQ3: } \begin{aligned} x &= 0 \\ \theta &= \pi \\ \phi &= 0 \end{aligned}$$

EOM

$$0 = f(q, \dot{q}, \ddot{q}, t)$$

↓ static force balance
solve for q 's \Rightarrow gives equilibrium q 's

Linearization Process

linear portion

n.b. lin.

linear portion

linear portion

linearization point

nonlinear

Taylor Series

$$f(x) = f(a) + \frac{f'(a)}{1!} (x-a) + \frac{f''(a)}{2!} (x-a)^2 + \dots$$

$$f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x-a)^n$$