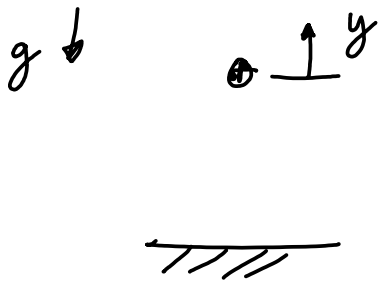## Basics of hybrid systems
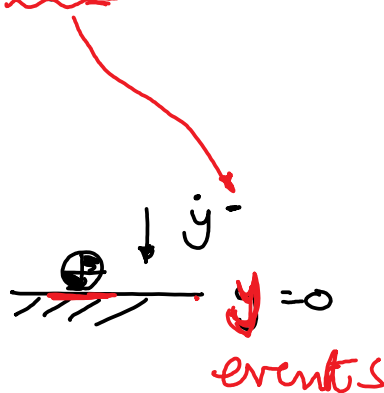- have different equations depending on which mode they are operating in

Example: Bouncing ball
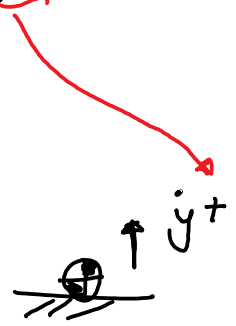
a) Free ball

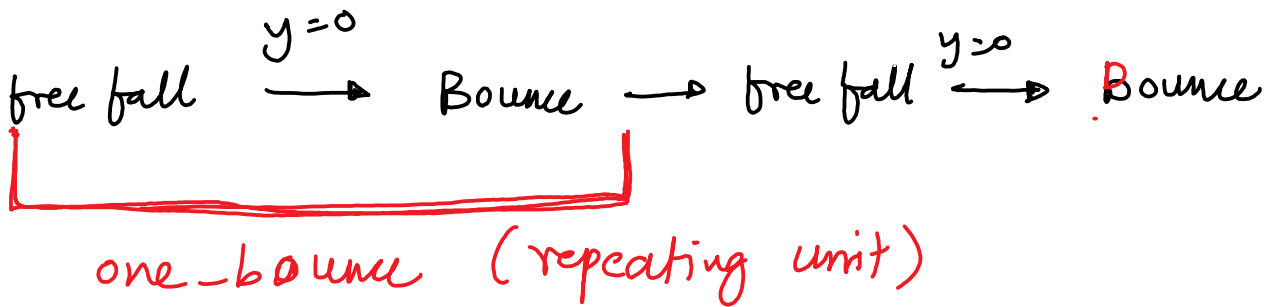b) Before bounce

c) After bounce

$g \downarrow$ $\uparrow y$

$\downarrow \dot{y}^-$ $y = 0$

events

$\uparrow \dot{y}^+$

a) free fall: $\quad \ddot{y} = -g$

b) bounce: $\quad \dot{y}^+ = -e \, \dot{y}^-$
   $y = 0$

$e =$ co-efficient of restitution

$0 \leq e \leq 1$

free fall $\xrightarrow{y=0}$ Bounce $\longrightarrow$ free fall $\xrightarrow{y=0}$ Bounce

one-bounce (repeating unit)

Code   ode45 hase 'events' to detect $y=0$ & stop integration