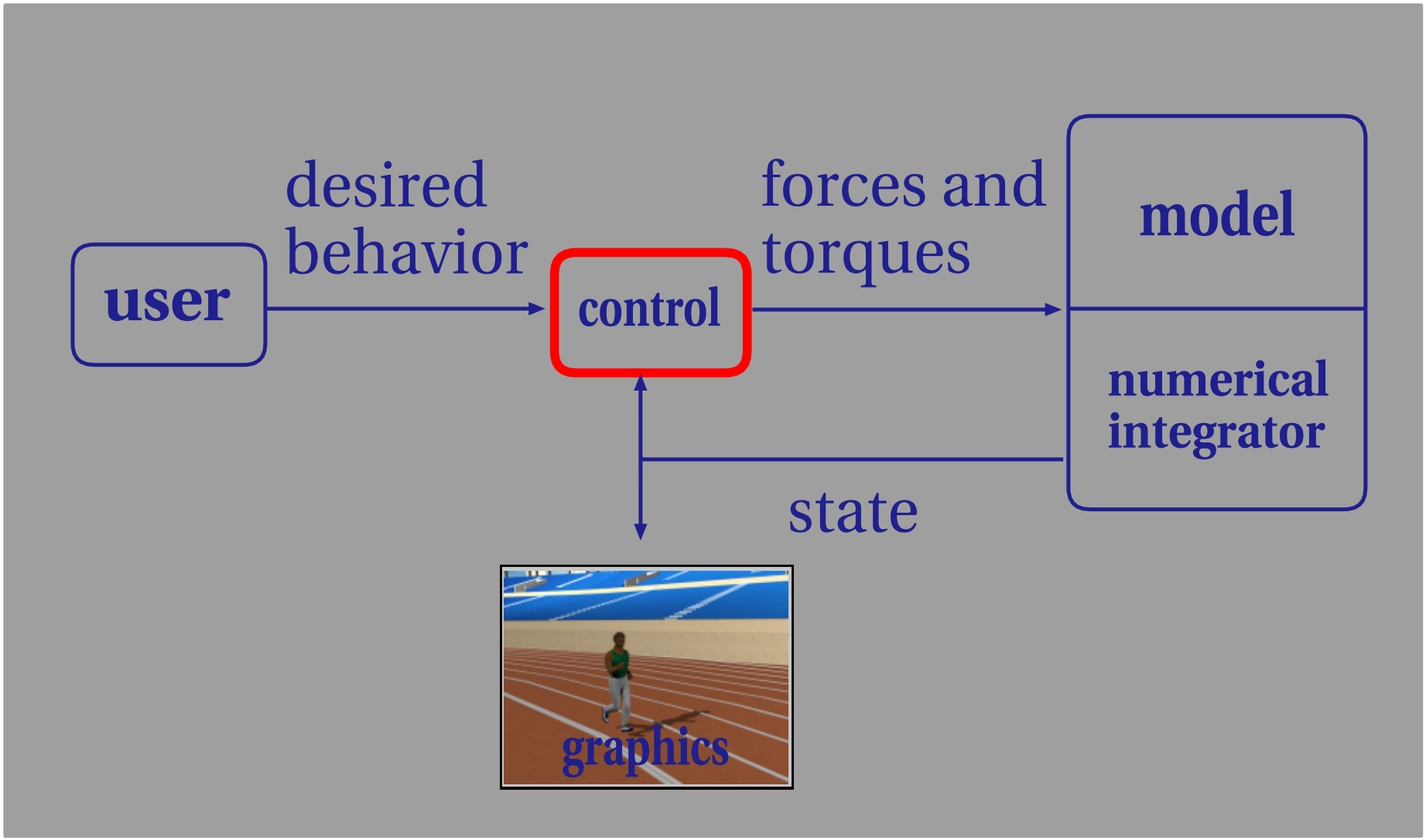

user
desired
behavior
control
forces and
torques
model
numerical
integrator
state
graphics

Dynamic Models and Control

Bruderlin, Calvert '89
van de Panne, Fiume, and Vranesic '90
Raibert and Hodgins '91
Hodgins, Wooten, Brogan, and O'Brien '95

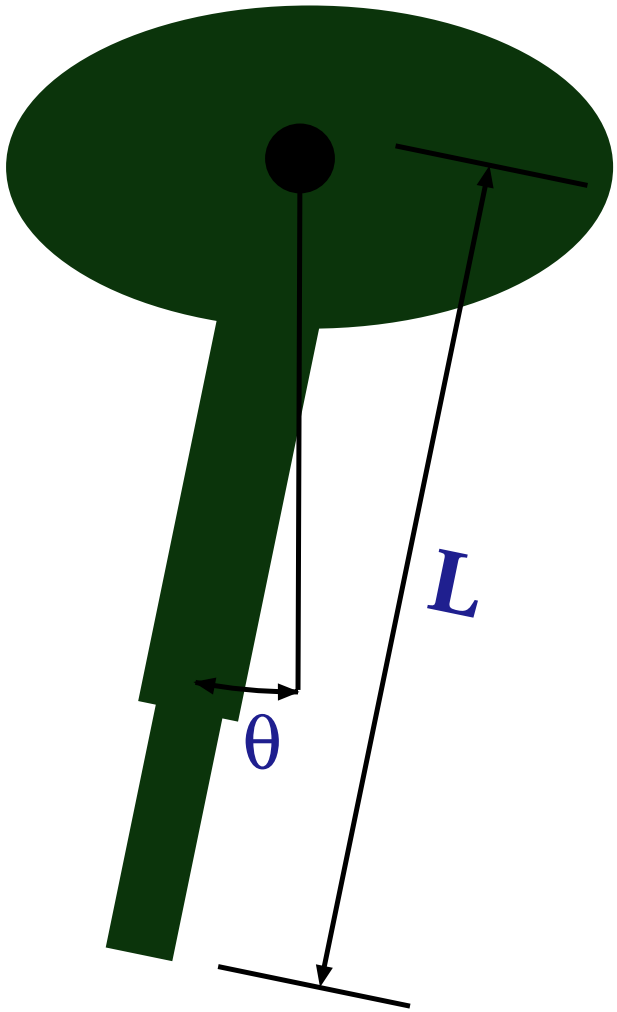
Generated Control Algorithms

van de Panne and Fiume '93
Ngo and Marks '93
Sims '94
Tu and Terzopoulos '94

Dynamic Model

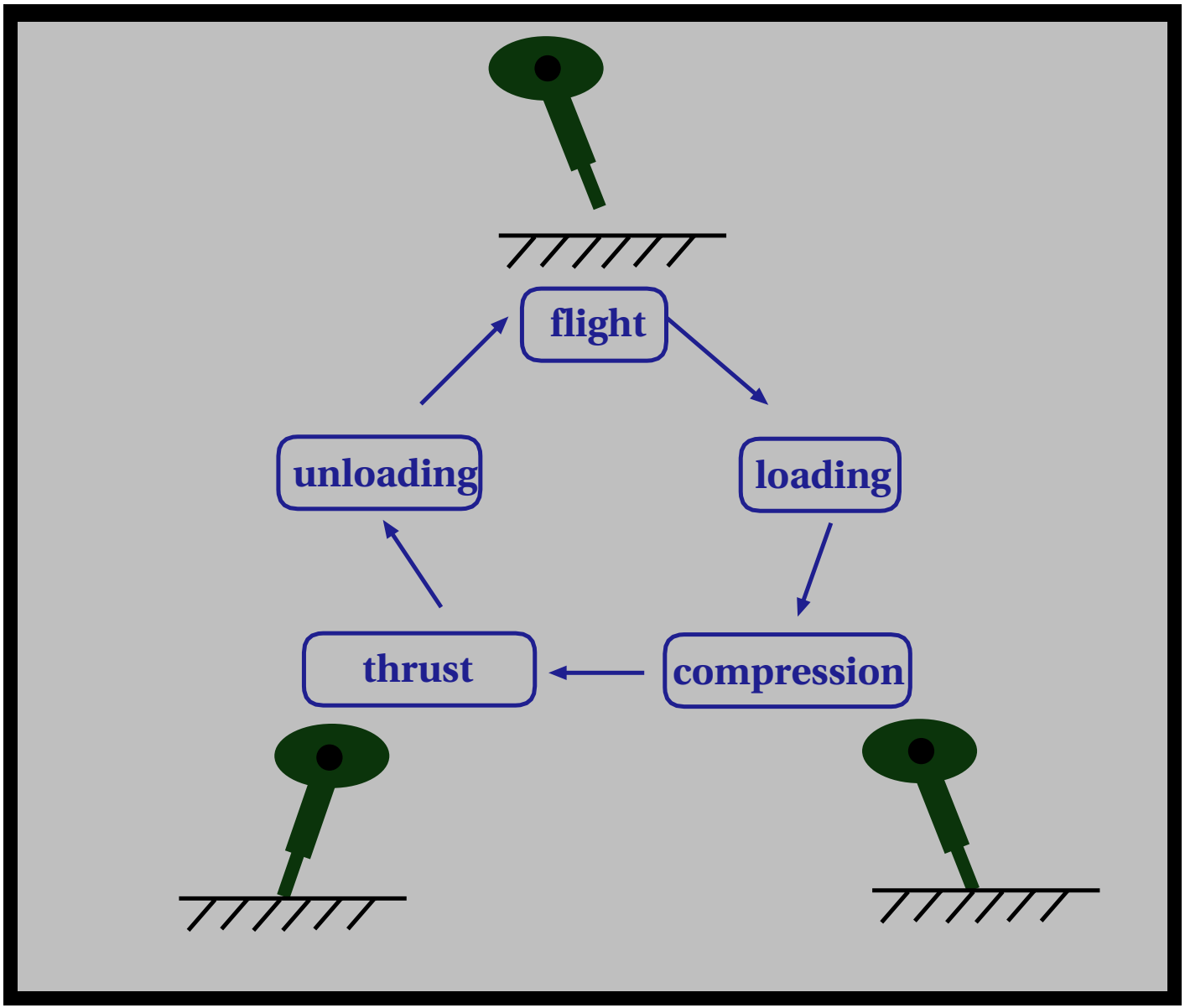
3 rigid bodies

2 or 4 controlled dof



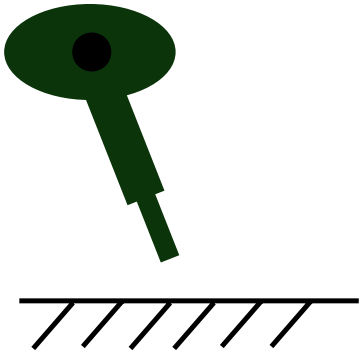
Control System

state machine to structure control actions

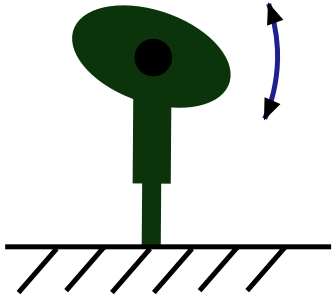


Control of Hopping

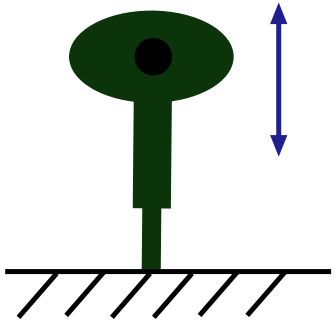
Velocity



Body attitude



Hopping height



Hierarchy of Control Laws

state machine
control actions
low level control

Low level control:
proportional–derivative servos

$$\tau = k_p(\theta_d - \theta) - k_v\dot{\theta}$$

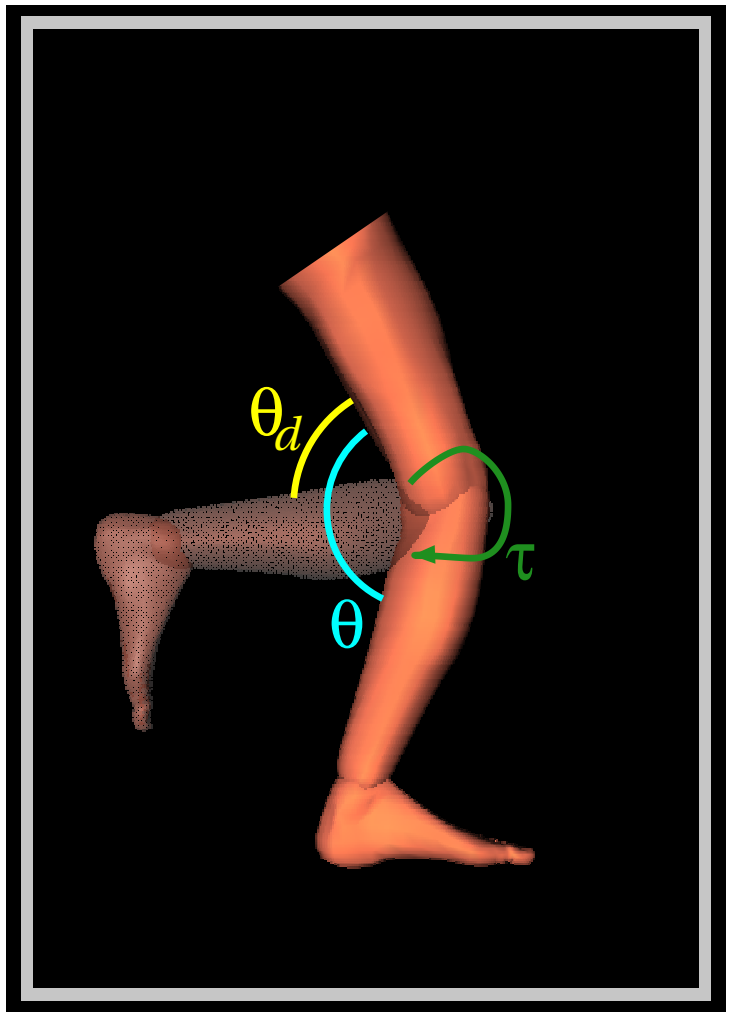
τ = Torque

$(\theta_d - \theta)$ = Error between desired and actual joint angle

$\dot{\theta}$ = Angular velocity

k_p = Position control gain

k_v = Velocity control gain



Control of Bipedal Running