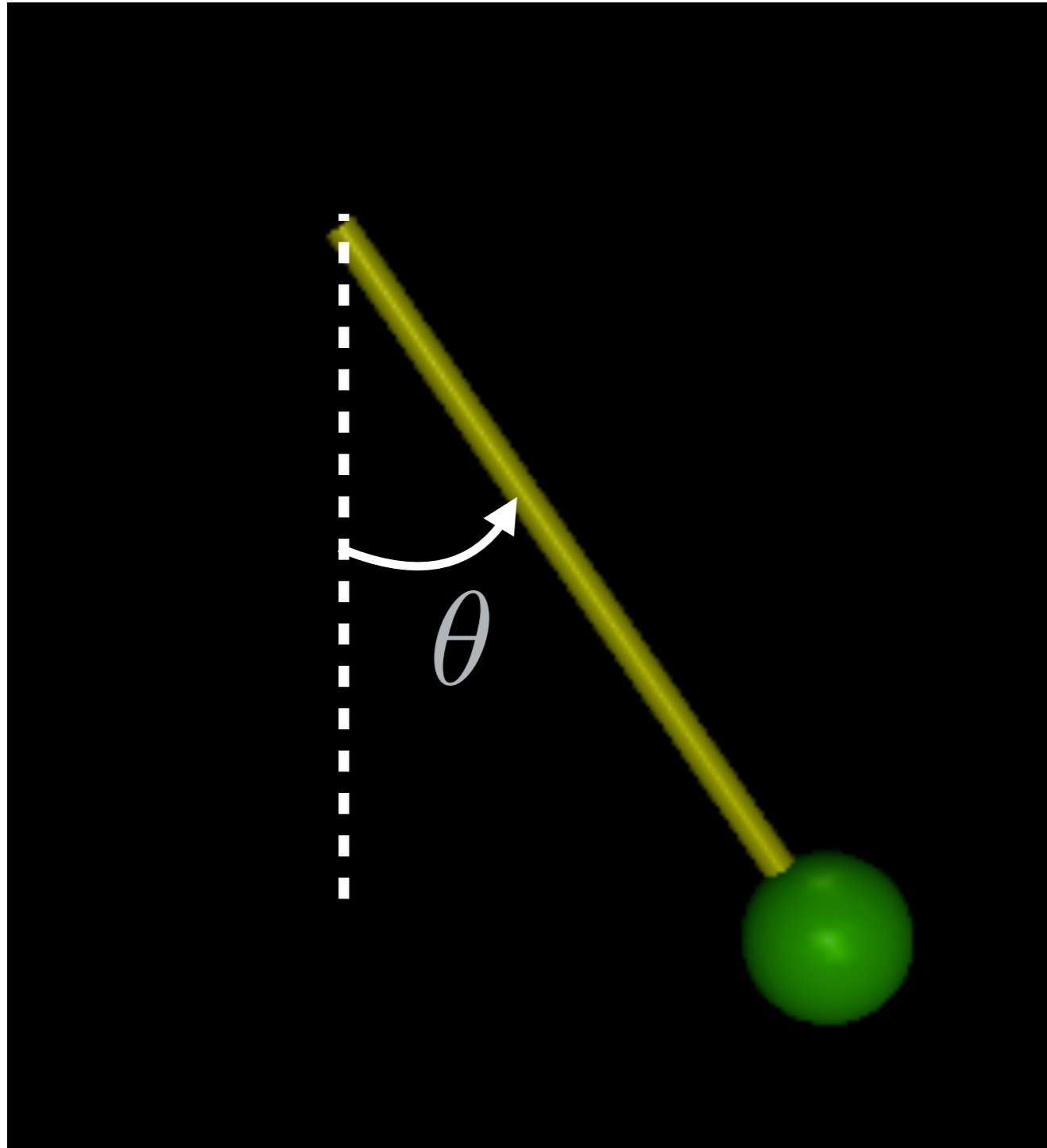


Control a simple pendulum



- 1) Position Servo
- 2) Velocity Servo
- 3) Position/Velocity Servo
- 4) Torque Servo

Control a simple pendulum

In XML add actuators

```
<actuator>  
  <motor name="torque_servo" joint="joint_name" >  
  <position name="position_servo" joint="joint_name" kp="0"/>  
  <velocity name="velocity_servo" joint="joint_name" kv="0"/>  
</actuator>
```

Actuator=0

Actuator=1

Actuator=2

Control a simple pendulum

Create a function to set the **Torque Servo***

Attribute	Setting	Attribute	Setting
dyntype	none	dynprm	1 0 0
gaintype	fixed	gainprm	1 0 0
biastype	none	biasprm	0 0 0

```
model.actuator_gainprm[actuator_no, 0] = 1
```

* <https://mujoco.readthedocs.io/en/latest/XMLreference.html#actuator-general>

Control a simple pendulum

Create a function to set the **Position Servo***

Attribute	Setting	Attribute	Setting
dyntype	none	dynprm	1 0 0
gaintype	fixed	gainprm	kp 0 0
biastype	affine	biasprm	0 -kp 0

```
model.actuator_gainprm[actuator_no, 0] = kp  
model.actuator_biasprm[actuator_no, 1] = -kp
```

* <https://mujoco.readthedocs.io/en/latest/XMLreference.html#actuator-general>

Control a simple pendulum

Create a function to set the **Velocity Servo***

Attribute	Setting	Attribute	Setting
dyntype	none	dynprm	1 0 0
gaintype	fixed	gainprm	kv 0 0
biastype	affine	biasprm	0 0 -kv

```
model.actuator_gainprm[actuator_no, 0] = kv  
model.actuator_biasprm[actuator_no, 2] = -kv
```

* <https://mujoco.readthedocs.io/en/latest/XMLreference.html#actuator-general>

Control a simple pendulum

- 1) Position Servo -> Spring-like behavior
- 2) Velocity Servo -> Control speed
- 3) Position/Velocity Servo -> Position Control
- 4) Torque Servo -> Can achieve 1), 2), 3) above

$$\text{Torque} = -K_p (\text{theta} - \text{theta_ref})$$

$$\text{Torque} = -K_v (\text{thetadot} - \text{thetadot_ref})$$

$$\text{Torque} = -K_p (\text{theta} - \text{theta_ref}) - K_v \text{thetadot}$$