Coordinate transformation on inverted pendulum such that feedback gains are gravity independent.

Equation of motion:

Define

The resulting equation is:

The gains are:

Analyzing the performance of the system:

Start with the equations of motion:

Linearize about = 0,

Put in control law for regulation about = 0:

Resulting equation is:

Second order system analysis is of the form:

Damped natural freq:

Percent overshoot

For this system:

Maximum static torque without foot lifting off:

d

mg