Advanced Control for Robotics: Homework #1

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1 ODE and Its Simulation

1.1 Equation of Pendulum Motion

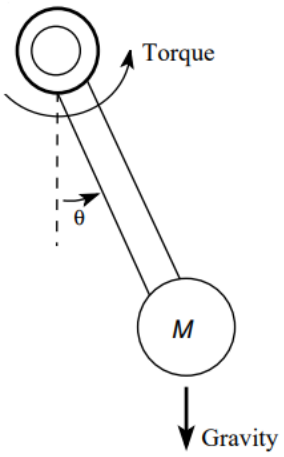

Figure 1: pendulum model

By applying the Newton's law of dynamics, a pendulum with no external force can be formulated as:

$$ml^2\ddot{\theta} + mgl\sin\theta - T = 0 \tag{1}$$

in which:
m is mass of the ball
l is length of the rod
g is the gravitational constant
θ is angle between the rod and the vertical axis, which is also the system output y
T is torque of the joint, which is also the control input u

2 Matrix calculus

3 Inner product

4 Some linear algebra

5 Gradient Flow