Robotics
Exercise 10

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1 Read the other exercise

On the webpage there is a 2nd exercise sheet *e10-riccati*. Please read this carefully. You don't need to do the exercise – the Octave solution was anyway in `07-cartPole/cartPole.m`. But you need to understand what's happening – we will do exactly the same for the Racer below.

2 Balance the Racer

Download the new `libRoboticsCourse.13.tgz` from the webpage. This now includes a folder `09-racer`, which simulates the racer using Runge Kutta. Note that $q = (x, \theta)$. Currently it applies a control signal $u = 0$. Design a controller $\pi : (q, \dot{q}) \mapsto u$ that balances the robot.

3 Use the local linearization and Algebraic Riccati equation

The code implements a routine `getDynamics` that, for the current state $(q, \dot{q})$, computes the local linear dynamics

$$M\ddot{q} + F = Bu$$

Use this to apply the Algebraic Riccati equation, as in the exercise *e10-riccati*, to compute a linear regulator using Octave. Test robustness w.r.t. system noise, that is, increasing `dynamicsNoise`.