**EM 502 Final Project**

Free response of the radial crane system

Objective:

Derive the non-linear dynamic model of the radial crane system (ECP 205 with pendulum attachment), and compare to experimental data.

Part a) Due Friday of 9th week:

The radial crane has two degrees of freedom defined by the disk twist angle, and pendulum swing angle relative to vertical. Find the kinematic equations needed to determine the total angular velocity of the pendulum and the total linear velocity of the pendulum mass center in space.

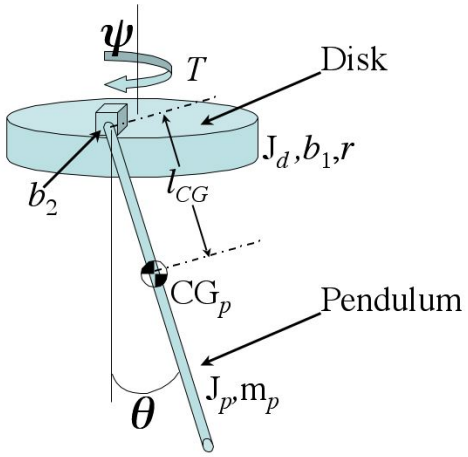


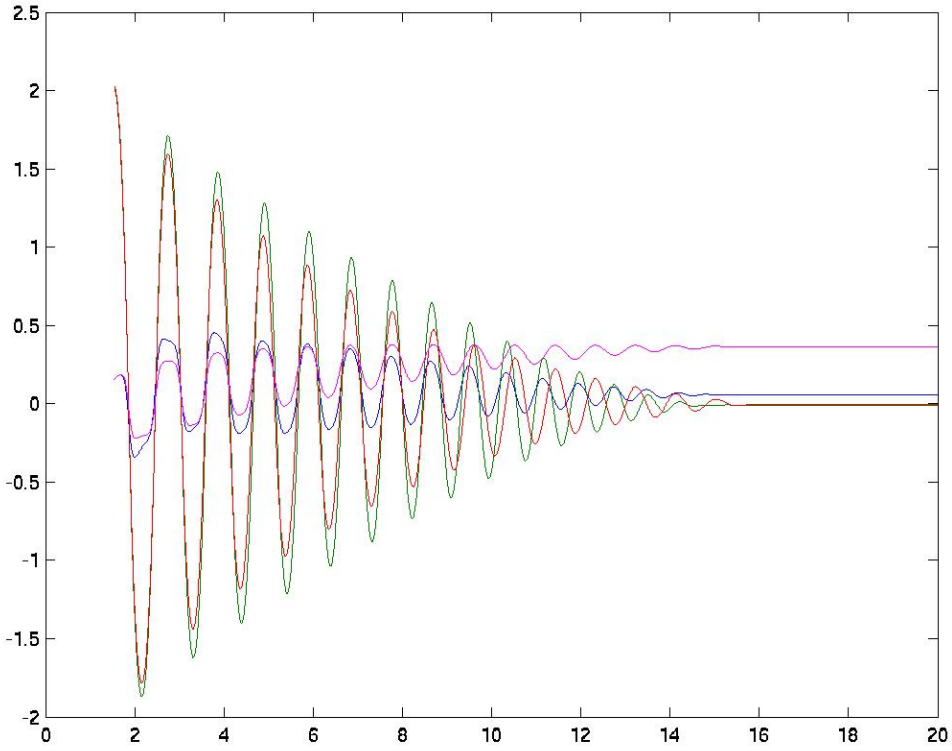

**Figure 1: Radial pendulum in crane mode**

Part b) Due Friday of 10th week:

Using the lab hardware in C116, obtain free response of the pendulum for an initial swing angle of approximately 90 degrees. Be careful to test that the plant base is level before taking data. Plot your experimental data to insure that it is smooth (no unwanted disturbances).

Use LaGrange's equations to determine the non-linear differential equations of motion for disk twist angle and pendulum swing angle, assuming the input torque is zero. Write a set of .m files to simulate this motion using ode45, and a top level function to find the best fit physical parameters using fminsearch to compare experimental free response to theoretical.

Report your results in a formal report. You should include any hand and computer algebra calculations from parts a) and b), a comparison of theoretical and experimental free response, and matlab code. A sample result is shown below.


2.5
2
1.5
1
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0
-0.5
-1
-1.5
-2
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2
4
6
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12
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16
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