Theoretical Optimization of Drive Wheel

UCSD MAE156a

Parameters you will need: Inertia of turntable: **0.000884 Kgm2** Inertia of Motor Armature: **4.97e-007 Kgm2**
Motor stall torque: **.005 Nm** Motor no load (max) speed: **416 rad/s**
Motor shaft diameter = **2.3 mm** Turntable diameter = **158 mm**

Assignment Overview:

A key part of the turntable project is selecting the size of the drive wheel. To optimize the size of the drive-wheel a simulation of the turntable is required. In this assignment you will use the model the turntable system without friction. Later each pair can add the friction value from their actual turntable to provide a more accurate simulation of their turntable and an improved drive-wheel size.

Reference

Use the example of Dynamic Optimization Example of a Mass Raised by a Pulley, at:

https://sites.google.com/a/eng.ucsd.edu/mae156a/machine-design

Step 1.

Write out the Ordinary Differential Equation (ODE) that needs to be solved. Use the equations derived in the dynamics of the turntable assignment along with the initial conditions. Also list the value of each parameter used in the simulation.

Step 2

Modify the Matlab code provided in the pulley example so that it models the turntable. Make sure to use Good Programming Practices as described at:

http://maelabs.ucsd.edu/mae_guides/analysis_guide/software/Good-Progamming-Practices.htm

Plot the turntable position and velocity vs time for a simulation of the motor shaft with no drive-wheel for a rotation of 540 degrees. The variables inside the code should be in radians, but plot results in radian and radians/second. Also turn in your commented Matlab code.

Step 3:

Run the Matlab simulation in a loop to find the optimal drive wheel size assuming no friction in the turntable. Turn in your commented Matlab code and a plot showing the optimal size drive-wheel.