

## MATLAB Assignment 7

November 13, 2014

When working on this assignment you might want to take a look at MATLAB code that was developed by students who took ME451 in previous years. The students back then did not come up with identical solutions. Take a look at their solutions and develop your own.

2010: <http://sbel.wisc.edu/Courses/ME451/2010/SimEngine2D/index.htm>

2011: <http://sbel.wisc.edu/Courses/ME451/2011/SimEngine2D/index.htm>

Turning in your assignment: place all your files in a directory called "lastName\_Matlab\_07", zip that directory, and upload the resulting file "lastName\_Matlab\_07.zip" in the appropriate Dropbox Folder at Learn@UW.

---

**Problem 1.** Consider the pendulum at page 60 of the textbook (Example 3.2.1). Use the pair of files `simplePend.acf` and `simplePend.adm` that you generated in a previous assignment. Recall that a motion is prescribed on the pendulum to the effect that its orientation should change like  $\phi(t) = \pi/2 + 2\pi t$ . The state of this model is to be characterized by an array of Cartesian generalized coordinates  $\mathbf{q} = [x, y, \phi]^T$ .

Use your `simEngine2D` simulator to perform a Kinematics Analysis of this mechanism. Upload the following information on the forum:

1. A plot of the acceleration  $\ddot{x}(t)$  as a function of time
2. A trajectory plot, that is a plot that uses  $x(t)$  on the horizontal axis and  $y(t)$  on the vertical axis.

### Notes:

- This problem will require you to go through parsing the ACF and ADM files, computing  $\Phi$ ,  $\Phi_{\mathbf{q}}$ ,  $\nu$ ,  $\gamma$ , implementation of Newton-Raphson method and solution of the position problem, solution of velocity problem, and solution of acceleration problem. It will basically take you through all major concepts related to Kinematic Analysis that we discussed in ME451.
- This assignment should be relatively straightforward given that you finished Project 1, which required you to perfect `simEngine2D` beyond what is needed for this assignment.