Quiz 2 (Take Home)

Date: April 9, 2021 at midnight   Instructor: Trani

Open book and notes, use of computer is allowed

Honor Code Pledge

The information provided in this exam is my own work. I have not received information from another person while doing this exam.

Your Name : _____

Important Instructions:

Create a single PDF file with all your solutions. Separate files are not acceptable. Show all your work and screen captures with formulas (if applicable) to receive credit. Matlab code needs to have plenty of comments for me to assess the solution. Also, please make sure the Matlab code screen captures are font size 10 (so they are readable).

Problem 1 (40 Points)

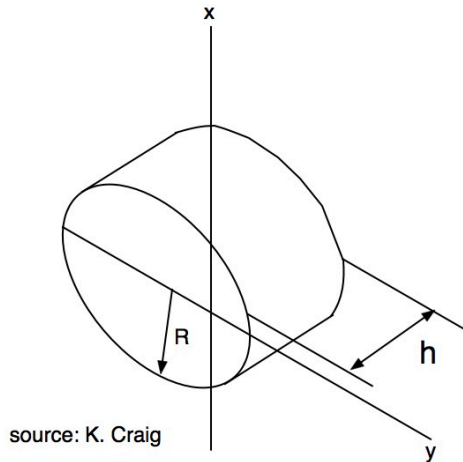Figure 1 shows a flywheel element used in building dampers to protect buildings against earthquakes.

Figure 1. Flywheel Mass.

The equations to estimate the moments of inertia of a cylindrical shape flywheel are:

$$J_{xx} = m(\frac{h^2}{12} + \frac{R^2}{4})$$

and

$$J_{yy} = \frac{m}{12}(4h^2 + 3R^2)$$

where:

m is the mass of the flywheel (in kilograms) and h and R and dimensions of the flywheel (meters).

a) Create a Matlab function to estimate the moments of inertia Jxx and Jyy of the flywheel. The function should accept three parameters: h, R and m. The outputs of your function are the moments if inertia Jxx and Jyy.

b) The mass of the flywheel is related to flywheel width h. Data provided in a separate Excel file shows information of flywheel mass for various dimensions h from previous lab tests. Use the data provided in the Excel file and create another Matlab function to estimate the mass of the flywheel (m) as a function of flywheel width (h).

c) Create a Matlab script and test the Matlab function created in parts (a and b) and estimate the numerical values of Jxx and Jyy using values of ranging from h = 0.4 to 1.2 meters at steps of 0.005 meters. For this solution use a constant value of R at 1.1 meters.

d) Plot two graphs with various solutions for Jxx and Jyy for various values of h (part c). One graph plots Jxx as a function of h and the second one Jyy as a function of h.

Problem 2 (40 points)

Data collected by the Federal Aviation Administration is presented in the hyperlink named **Airports_data** (file name is TAF_airports_final2017.xls) available on week 2 of the syllabus page. A small portion of the file is shown below.

Airport ID	Name	State	Air Carrier Passengers	Commuter Passengers	Latitude (seconds)	Longitude (seconds)
00V	MEADOW LAKE	CO	0	0	140204.6960N	376451.6160W
01G	PERRY-WARSAW	NY	0	0	153868.8480N	280987.4900W
02A	GRAGG-WADE FIELD	AL	0	0	118261.7400N	311801.1700W
02C	CAPITOL	WI	0	0	155115.0360N	317440.3290W
02G	COLUMBIANA COUNTY	OH	0	0	146423.9260N	290309.0630W
04Y	HAWLEY MUNI	MN	0	0	168781.7550N	346860.9350W
05C	GRIFFITH-MERRILLVILLE	IN	0	0	149471.4276N	314638.2287W
05U	EUREKA	NV	0	0	142575.0000N	417618.2150W
06A	MOTON FIELD MUNI	AL	0	0	116857.6980N	308448.1300W
06C	SCHAUMBURG REGIONAL	IL	0	0	151161.6270N	317164.4740W

The following information is provided:

Column A = Airport ID (a three alphanumeric number used by FAA)

Column B = Airport name

Column C = State where airport is located

Column D = Number of annual passengers boarding aircraft owned by large air carriers (like United, Delta, Southwest, etc.)

Column E = Number of annual passengers boarding aircraft owned by commuter air carriers (like United Express, Mesaba, ASA, etc.)

Column F = Latitude (seconds). Note "N" in the latitude value stands for North of the Equator

Column G = Longitude (seconds). Note "W" in the latitude value stands for West of the Greenwich meridian

a)   Import the data using the method of your choice. Tell me how you imported the data and show me the script used.

b)   Add code to the script in part (a) to find the number of airports in the U.S. that carry more than three million passenger boardings per year (including air carriers and commuter passengers combined).

c)   Add more code to part (b) to find the number and names of the airports in the State of California with more than 65,000 passenger boardings (including air carriers and commuter passengers combined).

d)   Create more code to find the number of airports by each state. First, identify the unique states in the nation and then count the number of airports by state.

e)   For part (d), output the solution found in a comma delimited file with two columns: 1) state (string), 2) number of airports (numeric).

Problem 3 (20 points)

Take a problem that you have done for another class this semester or recently in another class.

   a) Describe in a couple of paragraphs the problem including nomenclature used.

   b) Create a Matlab script to solve the problem.

   c) Show me the code and the answers for numerical values of the problem you solved.