Assignment 8: Matlab Functions

Date Due: April 11, 2022 Instructor: Trani

Problem 1

Figure 1 shows a flywheel element used to construct building dampers.

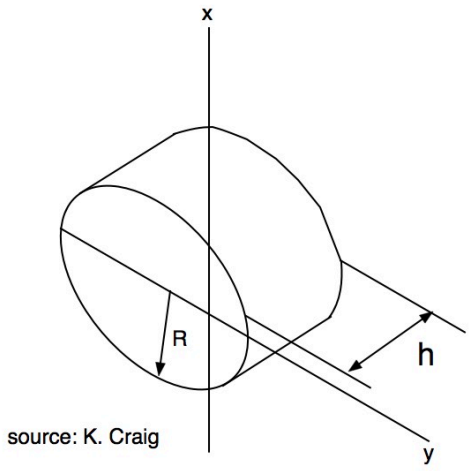

Figure 1. Flywheel mass.

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 (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) Create a Matlab script and test the Matlab function created in part (a) and estimate the numerical values of Jxx and Jyy using values h = 0.5 meters, R = 1.0 meters and m = 250 kilograms.

c) Add to the Matlab script created in part (b) and test the Matlab function find the numerical values of Jxx and Jyy with h = 0.5 meters, R = 1.0 meters and m changing from 200 to 400 kilograms. Do not use a FOR loop. Use vector operations.

Problem 2

Asphalt is a very important material to civil engineers. The fabrication of asphalt requires the material to be heated to allow better mixing. The first order differential equation (dT/dt) that estimates the rate of change of temperature of concrete as a function of time is:

$$\frac{dT}{dt} = -K(T - T_a)^m$$

$T =$ asphalt mix temperature (deg. C)

$K =$ heat release constant (1/minute)

$T =$ temperature of asphalt material (deg. C)

$T_a =$ ambient temperature (deg. C)

$m =$ constant of proportionality (dim)

a) Create a function in Matlab to estimate the rate of change of temperature (T) as a function of time (t). The function should accept three parameters: T, K, Ta, and m. The output of your function is (dT/dt).

b) Create a Matlab script and test the Matlab function created in part (a) to estimate (dT/dt) using values for K for asphalt is 0.043 (1/minute), m = 2.1 and ambient temperature is 15 deg. C. Evaluate the function for 100 linearly spaced concrete temperature (T) values ranging from 200 to 50 deg. C.

c) Create a plot of (dT/dt) versus Temperature.