ECOR 2606 Lab Test #2 v8

A simplified model of the suspension of a car consists of a mass *m*, a spring with stiffness *k*, and a damper with damping coefficient, *c*. A bumpy road can be modeled by a sinusoidal up-and down motion of the wheel $y = Y \sin(\omega t)$. From the solution of the equation of motion for this model, the steady-state up-and-down motion of the car is given by $x = X \sin(\omega t - \varphi)$. The ratio between amplitude *X* and amplitude *Y* is given by:

$$ratioXY = \sqrt{\frac{(c\omega)^2 + k^2}{\left(k - m\omega^2\right)^2 + (c\omega)^2}}$$

where *ratioXY* = is the ratio of X/Y of the amplitudes (dimensionless)
ω = is the frequency of the bumps (in radians/s)
k = spring stiffness for the suspension (in N/m)
c = damping coefficient of damper (Ns/m)
m = car mass (kg)

Part 1: Write an m-file function that, given values for *ratioXY*, *m*, k and *c*, computes and returns *ω*. Your function must be called *calcOmega.* Your function may assume that *ω* (omega) is between 0.01rad/s and 15rad/s. Have it generate an error if the value of *m* is less than or equal to zero.

Note: If ω and other parameters are known, the formula makes it easy to calculate *ratioXY*. Your function is to do the reverse: it is given *ratioXY* and other parameters and must calculate ω.

Part 2: Assume that m = 2000 kg, k = 500,000 N/m and c = 28 x 10^3 Ns/m. Produce a script file (script.m) that

i) Uses function *calcOmega* to create a plot (figure 1) of ω vs *ratioXY* for *ratioXY* from 1.1 to 1.4. You are expected to label the axes and so on.

ii) Outputs a table giving ω for *ratioXY* from 1.1 to 1.4 m in steps of 0.025. *ratioXY* should be output with 1 decimal place and ω with 3 (as shown below).

```
ratioX/Y  Omega (rad/s)
 1.100       d.dddd
 1.125       d.dddd
 1.150       d.dddd
  ... (and so on)
```

Part 3: Demonstrate your understanding of "no input/no output" functions and subfunctions by producing a single file (quiz2.m) that combines your answers to parts 1 and 2. When executed, script.m and quiz2.m should produce exactly the same results.

Submit calcOmega.m, script.m, and quiz2.m.