MATLAB EXERCISES

Problem 1. *Use matlab to approximate*

$$e^A = \sum_{n=0}^{\infty} \frac{1}{n!} A^n$$

for the matrix

$$A = \begin{pmatrix} 0.2 & 0.5 & -0.1 \\ -0.1 & 0.2 & -0.3 \\ 0.2 & 0.0 & 0.5 \end{pmatrix}$$

without using the built in expm function. Then use expm to check your answer. If necessary, adjust your code until the two answers agree to eight significant figures.

Problem 2. *Write a matlab function which computes and returns the matrix* e^A *for any square matrix* A*. If the input is not square, have your function print a warning and return the input matrix.*

Problem 3. *Consider the function* $F : \mathbb{R}^2 \to \mathbb{R}^2$ *given by*

$$F(x, y) = \begin{pmatrix} xy^2 + yx^2 \\ sin(xy) \end{pmatrix}.$$

Using Newton's Method, find a zero of F *(*x, y *so that* $F(x, y) = (0, 0)$*). Do this by deriving the Newton Sequence by hand, and writing a Matlab program which iterates the sequence form an initial guess. You might have to experiment a little to find a reasonable initial guess. If you have trouble locating an initial guess, try using matlab to plot* $||F(x, y)||$ *(for this consult the matlab documentation on the matlab function 'surf' which is used for creating surface plots).*

Problem 4. *Choose one of the following systems;*

- *Rössler*
- *Duffing*
- *Van der Pol*
- *Rabinovich-Fabrikant equations*
- *Chua's Circuit*
- *Damped drive pendulum*

Google the system and find it's differential equations. Simulate the system using ode45 as shown in class. Plot time series, and phase space behavior of the system. Experiment with your simulation and see if you can reproduce the results you find on the Google page (or wherever...).