Math 53 Chaos!: Homework 7

due Fri Nov 16 ... but best if do relevant questions after each lecture

Shorter to let you study for Midterm 2 (which is the day before this is due, and goes up to section 7.5). The only questions not relevant for the exam are those involving Lyapunov functions.

T7.6 (ODE review. For each case draw a sketch and give a simple matrix A that illustrates the case. Remember for degenerate eigenvalues there are two cases: A has or does not have a full set of eigenvectors)

T7.7

7.2 (ODE review)

T7.9 (ODE review)

7.10

T7.11 (use the $P(\mathbf{x})$ for the undriven Duffing oscillator) Please carefully sketch level curves of E for the case $c = 0$, and phase plane flow curves for $c > 0$.

Compu. Expt. 7.3 Forced damped Duffing oscillator. Answer the questions in the book for this experiment. You might want to use Matlab's `ode45` for the formulation as two coupled first-order ODEs. See for instance the end of

`http://math.dartmouth.edu/~m46s07/intro46.m`

Go out to at least 200 time units. Please produce a phase plane plot of the three different orbits and state an IC which leads to each: two period-6π orbits, one period-2π orbit. Remember to clean up your orbits by not plotting an appropriate amount of early 'settling' time. [Hint: to measure periods you'll need to plot graphs vs t; you don't need to hand these in].

T7.13 (easy but nice)

T7.17 For c) draw carefully the flow lines emanating from the saddles, and shade in the basin of $(0, 0)$.

7.9 (look at 7.8 first).

7.17 (isn't it weird how this nonlinear system behaves like a linear one?)