Investigation #1 • Models of Nonlinearity (math 990) • Diffusion & Nonlinearity

- intermediate report (1-2 pages) due Wednesday 31 January.
- final report (~5 pages) due Wednesday 07 February.
- remember that the class e-mail is open for discussion.
- please see me if you would like to clarify a course of action.

A) Continue the perturbation calculation to find the next correction for the periodic solutions to the nonlinear oscillation equation

$$y'' + A\,y - B\,y^3 = 0\ .$$

To what extent can these perturbation results be quantitatively verified using the *lect02.m* script?

B) The ODE solver *lect02.m* can be used to generate solutions that satisfy the two-point boundary values $u(0) = u(\pi) = 0$ that also has another node (zero) in the middle, $u(\pi/2) = 0$. What happens when one tries to initialize the time-dependent diffusion script with this steady solution? Note, since the script *lect01.m* requires uniformly spaced initial values, the Matlab interpolation function *interp1* might be useful in converting the data.

C) Numerically generate a few phase plane trajectories for the ODE problem Q6.5 in Drazin (p200). Adapt the Poincarè-Lindstedt method to find a perturbative representation for the periodic solutions. Produce numerical verification of the results. Is there a first integral for this system?

***)** I also think that it might be useful if class members maintain a simple webpage similar in spirit to the class webpage (accessable from *www.math.sfu.ca/~muraki*). A sample .html file can be found there – it can be easily modified for your own use. One problem is locating and setting up your web files so that they are accessible by others – I'm hoping to find some documentation on this, but please let me know if you happen to know how to do this (see *http://www.sfu.ca/acs/sfuwebhelp/publish.htm*).