

Due December 9, 2010

MTH 2140 Session 02 Quiz 5

Instructions: This is a self-scheduled quiz. You can work for as long as you like, but you can't take breaks. You are not allowed to work in groups or discuss problems with other people and you are not allowed to use notes, books, web browsers etc.

After you have gotten as far as you can in a closed-book environment, you can change pen color and work in an open notes, open book, open internet environment for half credit.

This quiz is optional and may be taken for extra credit to replace the lowest quiz grade.

The following system of differential equations (taken from Andronov, Vitt and Khaikin by way of Blanchard, Devaney and Hall) is a simple model of a glider:

$$\begin{cases} \dot{\theta} = \frac{s^2 - \cos \theta}{s} \\ \dot{s} = -\sin \theta - Ds^2. \end{cases}$$

Here the variable θ represents the angle of the glider to the horizontal and the variable s represents the speed of the glider. The parameter D is the drag-to-lift ratio.

1. Find the equilibria for this system in terms of the parameter D
2. Choose an equilibrium, linearize about it and determine its stability type. *Hint: Save yourself some algebra by simplifying the Jacobian matrix after substituting in the equilibrium point, but before finding the trace and determinant*