

Chemistry 5850 Fall 2005 Assignment 5

Due: Wednesday, October 19.

Weight of this assignment: 55 marks

1. It is possible to design systems with a given invariant manifold. Here is the procedure for a two-dimensional system with a one-dimensional invariant manifold:

- (a) Pick the equation you want the variables to obey on the manifold, i.e. some relation $y = h(x)$.
- (b) Write down a differential equation for x .
- (c) You can now determine the differential equation for y from the manifold equation.

Use this procedure to design a system with a stable equilibrium point at the origin and a slow or centre manifold. Prove that you have achieved your goal using a linearized stability analysis. In particular, you should check that the slope of the equation you chose for your slow/centre manifold is the same as the direction given by the slow/centre eigenvector. [15 marks]

2. Carry out a complete analysis of the system

$$\begin{aligned}\dot{x} &= -x - y, \\ \dot{y} &= -xz, \\ \dot{z} &= xy + R\end{aligned}$$

using any techniques you think are appropriate. [40 marks]