Chemistry 5850 Summer 2004 Assignment 5

Due: Tuesday, June 22.

Weight of this assignment: 100 marks

Notes: All the equations in this assignment are already in dimensionless form. The last two questions are open-ended, but I do expect you to try a reasonable range of techniques and to provide a thorough report of your findings.

1. Prove that the system

$$\begin{aligned} \dot{x} &= -x, \\ \dot{y} &= -\gamma y + \frac{(\gamma-1)x+\gamma x^2}{(1+x)^2} \end{aligned}$$

   has a slow manifold given by

$$y = \frac{x}{x+1}$$

   for $x > 0$ and $\gamma > 1$. [20 marks]

2. Carry out a complete analysis of the system

$$\begin{aligned} \dot{x} &= -xy, \\ \dot{y} &= -y + x^2 - 2y^2. \end{aligned}$$

   Use any methods which you think are appropriate. [30 marks]

3. Carry out a complete analysis of the system

$$\begin{aligned} \dot{u} &= -vw + bvz, \\ \dot{v} &= uw - buz, \\ \dot{w} &= -uv, \\ \dot{x} &= -z, \\ \dot{z} &= x + buv. \end{aligned}$$

   Use any methods which you think are appropriate. [50 marks]

Lecture 6 will be held on **Tuesday, June 22**. It will be followed by a test on **Thursday, June 24**. The test will cover everything up to the end of lecture 5. The assignment handed out at lecture 6 on June 22 will not be due until lecture 7 (Tuesday, June 29).

The test will include some small technical exercises which can be completed by hand, but will also include some conceptual questions. Make sure to study the definitions and to think about what the material covered means, not just how to do things.