

Bonus Homework

Mathematical Modeling

Due: September 26, 2018

1 Problems for Everybody

For each of the following problems sketch all qualitatively different phase portraits that occur as r is varied. Sketch a bifurcation diagram of fixed points x^* versus r . **If possible determine the bifurcation point explicitly.** In each bifurcation diagram determine what type of bifurcation occurs.

1. $\dot{x} = 5 - re^{-x^2}$.

2. $\dot{x} = rx - 4x^2$.

3. $\dot{x} = rx + x^3 - x^5$.

4. $\dot{x} = r + x - \ln(1 + x)$.