

MA573 - Fall 2019 Homework 11 - Due November 22nd

Hirsh-Smale-Devaney Problems

Chapter 9: 4, 6,7(c,e),8(a,d),16 (for this one try to explain intuitively why this result is true, you do not need to rigorously prove it),

Extra-Credit problem (4pts): 17,

Non-textbook Problem(s): Problem 1: Consider

$$\begin{aligned}x' &= \mu x - y + xy^2 \\y' &= x + \mu y + y^3\end{aligned}$$

with parameter $\mu \in \mathbb{R}$. Using linearized analysis around the origin show that a Hopf bifurcation occurs at the origin as μ is varied. Then, use numerical investigation and/or phase plane analysis to determine whether the bifurcation is super-critical or sub-critical, that is does a stable limit-cycle bifurcate out of the origin as the equilibrium goes unstable? or does an unstable limit-cycle collapse onto the origin, rendering it unstable?