Huazhong University of Science and Technology

AUT5951

Spring 2022 05/24/2022

Homework 3 - Foundations of Data Science

Homework 3 Due: 12:00 3 June 2022

Problem 1

Consider the Van der Pol differential equation:

$$y'' + \epsilon \left(y^2 - 1\right) y' + y = 0 \tag{1}$$

which has the nonlinear damping term $\epsilon (y^2 - 1) y'$.

- (a) With $\epsilon=0.1$, solve the equation and write out the solution for $t\in[0:0.5:30]$ for initial conditions y(0)=0.1 and y'(0)=-1. Repeat with $\epsilon=1$ and $\epsilon=20$.
- (b) Now consider the problem when the parameter epsilon is not constant, but rather

$$\epsilon = \epsilon (t) = \begin{cases} 0.1 & t \in [0, 10] \\ 1 & t \in [10, 20] \\ 20 & t \in [20, 30] \end{cases}$$
 (2)

Generate the trajectory for $t \in [0:0.5:30]$ for initial conditions y(0) = 0.1 and y'(0) = -1.