

Indian Institute of Technology Kanpur
Department of Electrical Engineering
EE705 Intelligent Systems and Control
Matlab Test MM 30 08 October 2021

1a. The plant is described by

$$x(k+1) = \frac{x(k)}{1+x(k)^2} + u^3(k)$$

Generate 1000 input-output pairs of training data by exciting the plant by random input of uniform distribution from -1 to +1 and normalize the data. Model this plant data using an RBFN as well as an MLN network.

Take the number of centres of RBFN to be 100 and fix them by taking random values of uniform distribution from 0 to 1.

Take a single hidden layer of 10 neurons for the MLN. Add a bias both in the input and hidden layer.

Train their weights using the gradient-descent algorithm with adaptive learning rate.

Validate the model while taking the input to the system as $u(k) = \sin(0.2k)$ where $k = 1$ to 1000.

Plot the desired and actual output of the network while training and also, while testing. Plot the mean square error across number of epochs while training.

1b. Implement a network inversion based controller using the above trained RBFN such that the plant output follows the desired trajectory $x(k) = \sin(0.1k)$. Plot the input as computed by the controller. Compare the desired output and actual output. Take $u(0) = 0.01$ and $x(0)=0$.