

EEE 391
Basics of Signals and Systems
Computer Assignment 3
due: 18 April 2016, Monday by 17:00 on Moodle

1) First and second-order recursive equations are very useful in describing, modeling, and characterizing a variety of systems in basic sciences, engineering, finance, daily life, etc.

Give three examples of first-order and three examples of second-order systems that can be modeled by recursive equations. The examples can be from any area that you like (e.g., basic sciences, engineering, economics, finance, fashion, daily life, etc.). Describe your model in detail and write the corresponding recursive equation, indicating what each term and coefficient corresponds to. You do not need to solve these examples.

Solve the following examples of recursive systems:

1) A water reservoir with 5,000 tons of water on day zero, loses 3% of its water content through water usage and evaporation every day. On the average, the reservoir gains 65 tons of water every day through rain immediately and 180 tons through rivers flowing into the reservoir with a delay of 12 hours.

- i) Build a recursive model, indicating what each term is clearly.
- ii) Find the amount of water at the start of each day starting on day zero. First, do this by analysis to find a complete solution and then write a MATLAB program to solve the above recursive model, with suitable initial conditions.
- iii) Is the reservoir a stable system? Explain.

2) At the start of a certain year, 40,000 TL is deposited in a bank account earning 9% interest per year. After the initial deposit, in the succeeding years, 1,000 TL is deposited or 2,500 TL is withdrawn from the account alternately (The first year 1,000 TL deposited, the next year 2,500 TL withdrawn, the following year 1,000 TL deposited etc.).

- i) Build a recursive model, indicating what each term is clearly.
- ii) Find the balance of the bank account at the start of each year after the deposit. First, do this by analysis to find a complete solution and then write a MATLAB program to solve the above recursive model, with suitable initial conditions.
- iii) Is the system stable? Justify.