EXPERIMENT #6

Modelling of Phsical Systems and Computer Simulation Using MATLAB

1. **Preliminary Work**
   - **1.1.** Consider the system in Figure 1 where A is the cross-sectional area of the tank.
     - **1.1.1.** Derive the governing differential equation for the system and find the transfer function.
     - **1.1.2.** What is the time constant of the system?
     - **1.1.3.** If a unit step change occurs in the flow, what is the steady-state change in the head?
   - **1.2.** Consider the closed-loop system in Figure 2 where G(s)=1/s(s+0.1)
     - **1.2.1.** Derive the closed-loop transfer function T(s) for the system. Would the response be underdamped, critically damped, or overdamped? If underdamped, what is the period T of oscillations?

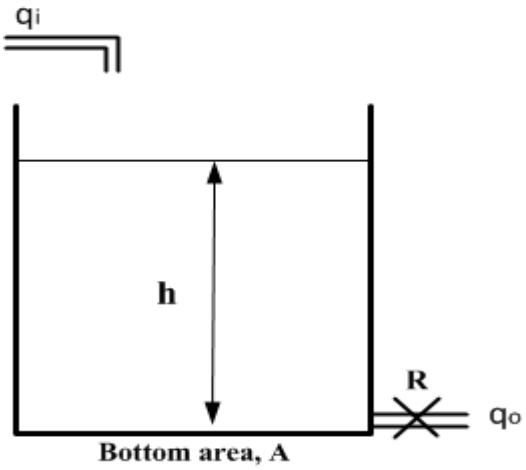

Figure 1

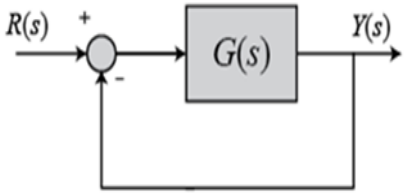

Figure 2

2. **Experimantal Work**

The following stages will be carried out using the program MATLAB

- **2.1.** Let A=5 and R=1. Enter the transfer function you obtained in part 1.1. as G1. Obtain the time domain step response of the system using the corresponding MATLAB commands. Sketch the graph you have observed on a sheet of paper. Verify the results you obtained in parts 1.1.2 and 1.1.3.
- **2.2.** Enter the transfer function you obtained in part 1.2. as G2. Obtain the time domain step response of the system using the corresponding MATLAB commands. Sketch the graph you have observed on a sheet of paper . Verify the results you obtained in parts 1.1.2 and 1.1.3.

3. **Results and conclusions**
   - **3.1.** Compare the results you have obtained using the computer simulation with the ones you obtained in the preliminary work.
   - **3.2.** Consider the closed loop system in Figure 2. Popose a method to get a less oscillatory step response (a more stable system).