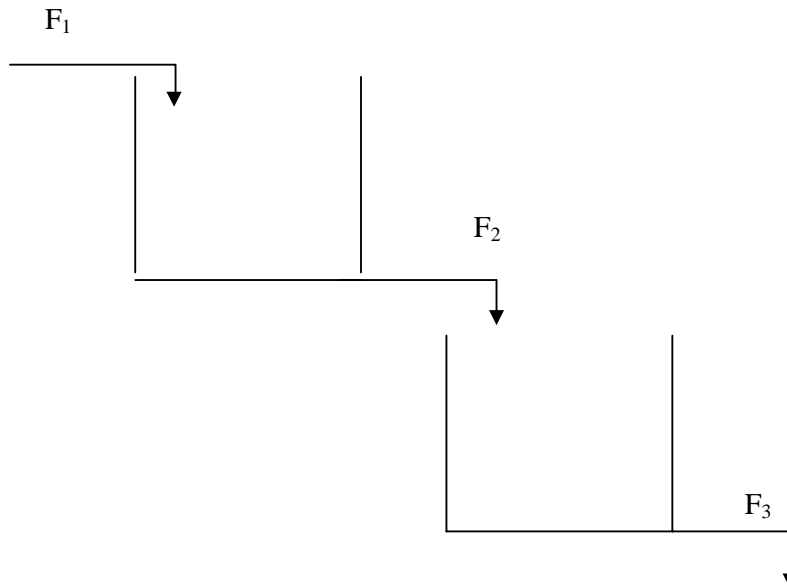


King AbdulAziz University
College of Engineering, Chemical Engineering Dept.
Fall 2004 HW#7 Ch.E 442

(Design)

1. Problem IV.2 in the textbook (Chemical Process control by G. Stephanopoulos).
2. We like to control the liquid level, h_2 , in tank 2 of the following system:



There exist three alternative manipulated variables, F_1 , F_2 , and F_3 .

- a) Draw the block diagram of the closed-loop system using a PI controller and F_1 , F_2 , and F_3 as manipulated variable.
- b) Derive the corresponding closed-loop responses to load or set point changes.
- c) Derive a general expression for closed-loop static gains for each of the corresponding three cases.
- d) Identify the corresponding closed-loop transfer functions for changes in the load (G_{load}) or set point (G_{sp}).

Assume that transfer functions of the measuring devices and control valves are equal to unity. Also assume that the flow rates of the free streams are linear functions of the liquid level.