Department of Chemical Engineering
Tutorial Sheet No.5

Subject: Chemical Process Simulation   Semester: 7th, Chemical Engineering

Q1. Let us consider the problem sketched in Fig.1, Petroleum pipelines are sometimes used for transferring several products from one location to another on a batch basis, i.e., one product at a time. To reduce product contamination at the end of a batch transfer, a leather ball or õpigö that just fits the pipe is inserted in one end of the line. Inert gas is introduced behind the pig to push it through the line, thus purging the line of whatever liquid is in it. *Write a force balance on the liquid still in the pipe as it is pushed out.*
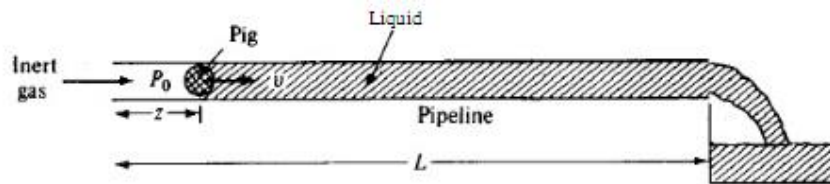

Figure 1

Assumptions: Must take into account the changing mass of material. Assume the pig is weight less and frictionless compared with the liquid in the line. Let z be the axial position of the pig at any time. The liquid is incompressible (density p) and flows in plug flow. It exerts a frictional force proportional to the square of its velocity and to the length of pipe still containing liquid.

Q2. A mixture of two immiscible liquids is fed into a decanter. The heavier liquid   settles to the bottom of the tank. The lighter liquid   forms a layer on the top. The two interfaces are detected by floats and are controlled by manipulating the two flows F   and F

F = K h

$$F = K (h + h)$$
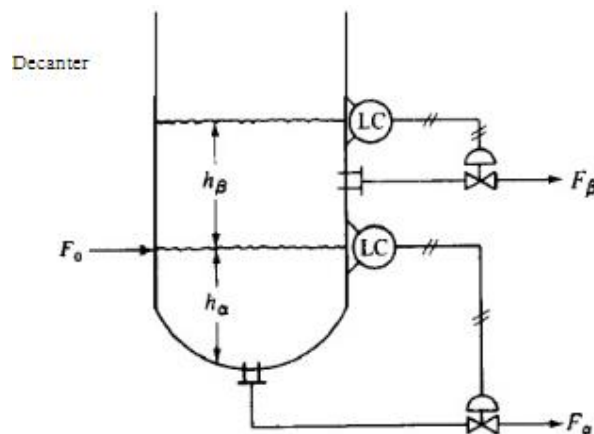
The controllers increase or decrease the flows as the levels rise or fall. The total feed rate is F_0. The weight fraction of liquid in the feed is x . The two densities and are constant. Write the equations describing the dynamic behavior of this system.