ME 4232: Fluid Power Control Lab

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Labs 11&12: Asynchronous and Synchronous operations & Tandem and parallel connections

Objective

In many applications multiple actuators are connected in a given circuit. Sometimes these actuators should act synchronously (at least at the same time). The first part of the lab is to study the issues and methods for making 2 actuators operate synchronously.

In other applications, it is desired that one actuator be moving all the time, while the second actuator can be turned on/off. It is advantageous if the speed of the first actuator does not depend on whether the second actuator is in operation (This case is exactly opposite to the requirement of the first part). In the second part of this lab, it is intended that a hydraulic motor be continuously operating (hopefully at constant speed) regardless of whether the actuator is turned on or not.

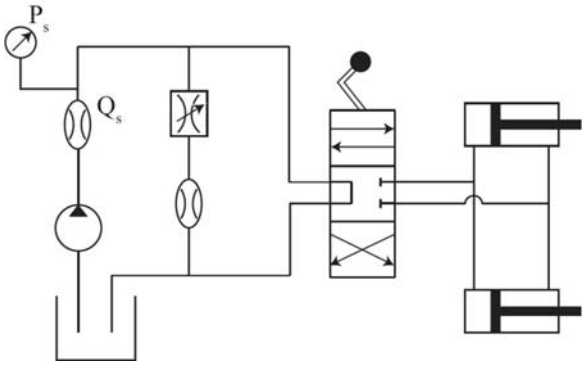

Figure 1

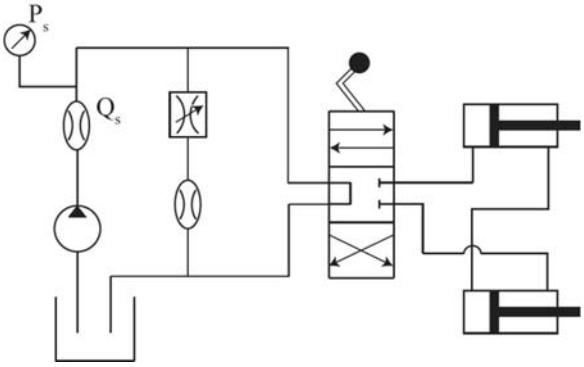

Figure 2

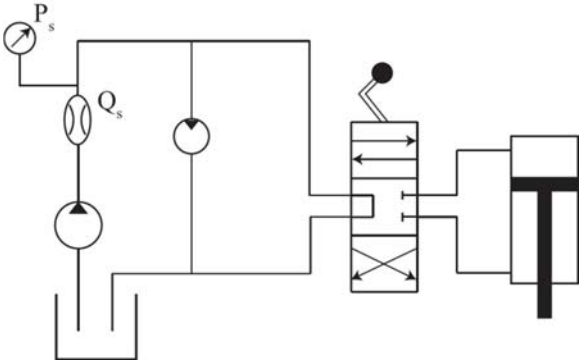

Figure 3

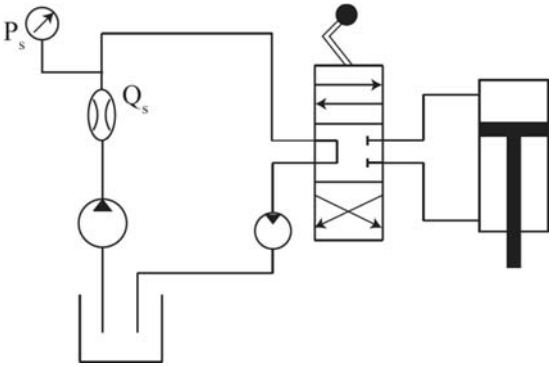

Figure 4

Pre-Lab – Due as a hardcopy at the beginning of lab

Give a description of the flow paths and the operation of each of the above circuits. In your description be sure to address the sequence of operation as well as the flow rate to each actuator during operation.

Procedure (Part 1: Figures 1&2)

- Construct the circuit shown in Figure 1
- Predict qualitatively how the circuit will behave.
- Observe and comment on the motion of the actuators for various settings of the needle valve.
- Repeat the previous two steps for the circuit shown in Figure 2.
- Which of the circuits is able to achieve synchronization?
- How could the circuit be modified to not only ensure synchronization but that each actuator acts at the same speed? Test your hypothesis.

Procedure (Part 2: Figures 3&4)

- Identify the various "states" of operation of the circuit (i.e. valve position)
- Predict qualitatively the speed of the motor for the various states in the parallel circuit (Figure 3)
- Repeat the above step for the tandem circuit (Figure 4)
- Construct the parallel circuit
- Test and compare your predictions with your observations
- Repeat the two previous steps for the tandem circuit
- Based on your observations, which of these circuits do you think is best for maintaining a constant motor speed?
- Relate these observations to the results from the previous part.

Report

Your report should include the following:

- Brief description of the experiments
- Explain in detail about your qualitative predictions for your circuits. (If possible use a table to organize your predictions and results)
- Be sure to report and explain actuator velocities relative to each other, with various external loads on the system, and at various states.
- P1: Document any new circuit arrangements you propose for achieving both synchronization and equal velocities while extending and retracting.
- P2: Based on the predictions and the experimental data, comment on which circuit is better in maintaining the motor speed constant in the presence of a second actuator.
- Compare and contrast the four circuits.