

Flow Control

General Description

The process consists of a pump which can be actuated to put water from a tank (A) to the tank (B) through a pipe (water goes back to tank (A) by gravity). A transducer (C) allows to know the water flow into the pipe. The aim of the experiment is to control the water flow provided by the pump.

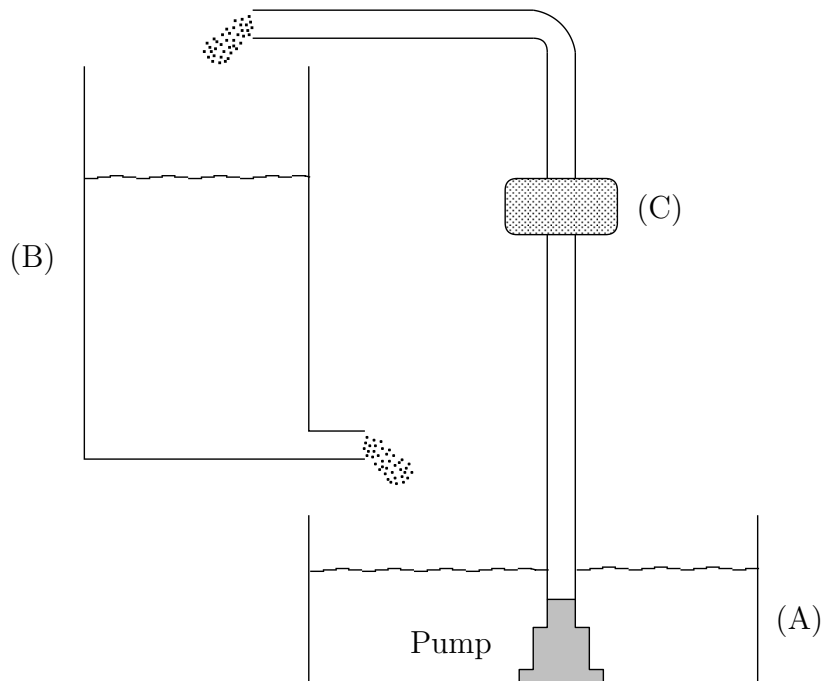


Figure 1: Sketch of the process.

Process Parameters

Pump max. voltage	8 V
Pump max. flow	52.3 ml/s
Max. pump voltage for no flow	3.7 V

Mathematical Model

Through experimental measurements, some static values of flow provided by the pump have been reported in Table 1. These values have been plotted in Figure 3. Note that the pump characteristics shows a nonlinear behaviour. Let $P(u)$ be the steady-state pump flow for a given voltage u as provided in Table 1, an approximated relationship between the actual flow and the pump command may be described as a Hammerstein model as reported in Figure 2.

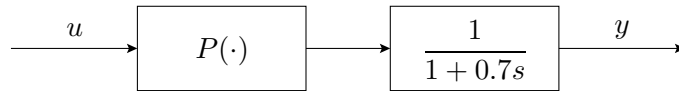


Figure 2: Block diagram.

Pump Command (V)	Flow (ml/sec)
0	0
3.7	0
4	7.6
4.5	17.5
5	25.1
5.5	31.5
6	37.3
6.5	42.5
7	47.4
7.5	52.0
8	52.3

Table 1: Flow provided by the pump for various command inputs.

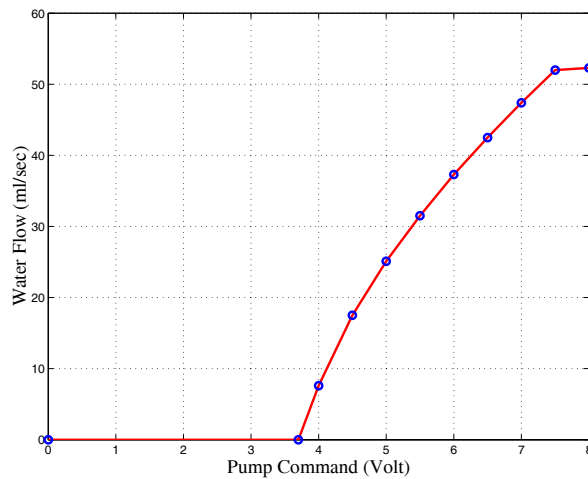


Figure 3: Pump characteristics.