Winter 2011
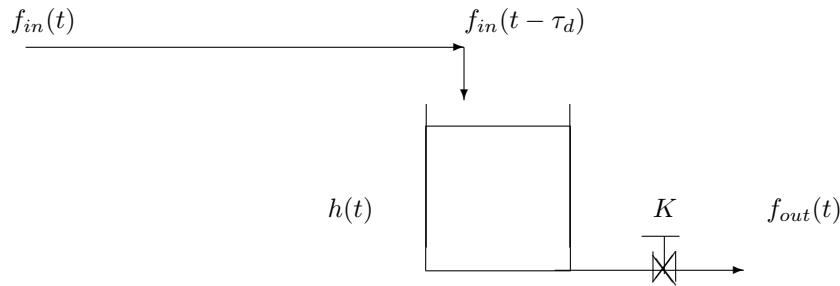
Due 11:00 a.m., Feb 3, Friday

Q.1: For the physical processes given in the Figure below, with parameters $\tau_d = 4.1430$, $K = 1/3$ and $A = 1$:

1.) Provide the model description in the form of the physical law that govern the process (Hint: Mass Balance)

2.) Find the corresponding discrete system if the sampling time is $\triangle t = 1sec$

Q.2: Sample the continuous time system

$$\frac{dx(t)}{dt} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t - 0.2) \tag{1}$$

using the sampling interval $\triangle t = 0.3$.

Q.3: Consider the following systems:

- Given
$$x(k + 2) - 0.5x(k + 1) + 0.3x(k) = u(k + 1) \tag{2}$$

  Determine the polynomial $A(q)$, $B(q)$ in the representation $A(q)y(k) = B(q)u(k)$.

- Given
$$x(k) - 0.5x(k - 1) = u(k - 3) + 0.4u(k - 5) \tag{3}$$

  Determine the polynomial $A^*(q^{-1})$, $B^*(q^{-1})$ in the representation $A^*(q^{-1})y(k) = B^*(q^{-1})u(k - d)$.

Q.4: Solve the Exercise 2.1. on page 27 in your notes.