练习题

1.

Solve the ODE, $\dddot{y} + +6\ddot{y} + 11\dot{y} + 6y = 1$, with zero initial conditions. Using Laplace transforms, partial fraction expansion and inverse Laplace transforms.

2. Using final value theorem to find $y(t=\infty)$ for

$$Y(s)=\frac{5s+2}{s(5s+4)}$$

3

Consider the following transfer function:

$$G(s) = \frac{Y(s)}{U(s)} = \frac{5}{10s + 1}$$

(a) What is the steady-state gain?

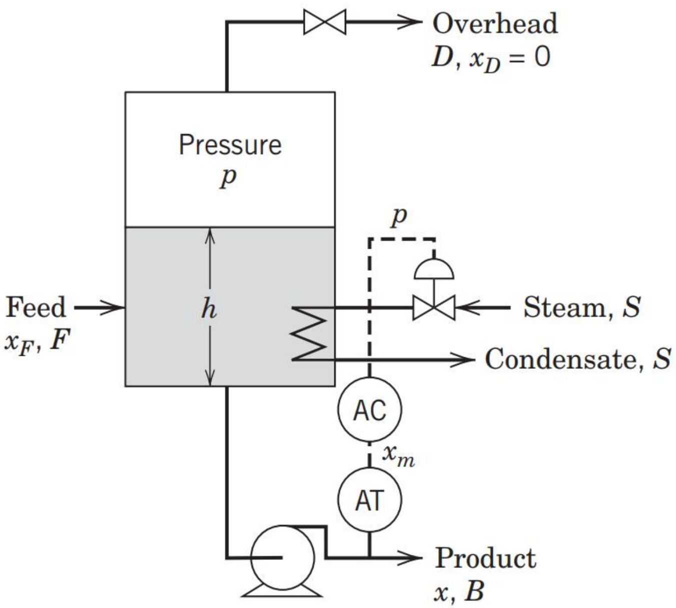
(b) What is the time constant?

(c) If $U(s) = 2/s$, what is the value of the output $y(t)$ when $t \to \infty$?

(d) For the same $U(s)$, what is the value of the output when $t = 10$? What is the output when expressed as a fraction of the new steady-state value?

4

A steam-heated evaporator used to concentrate a feed stream by evaporating water is shown in figure below. The mass fraction of solute in the exit stream x is measured and controlled by adjusting the steam flow rate, S.



Questions:

(1) Draw block diagram for this control system

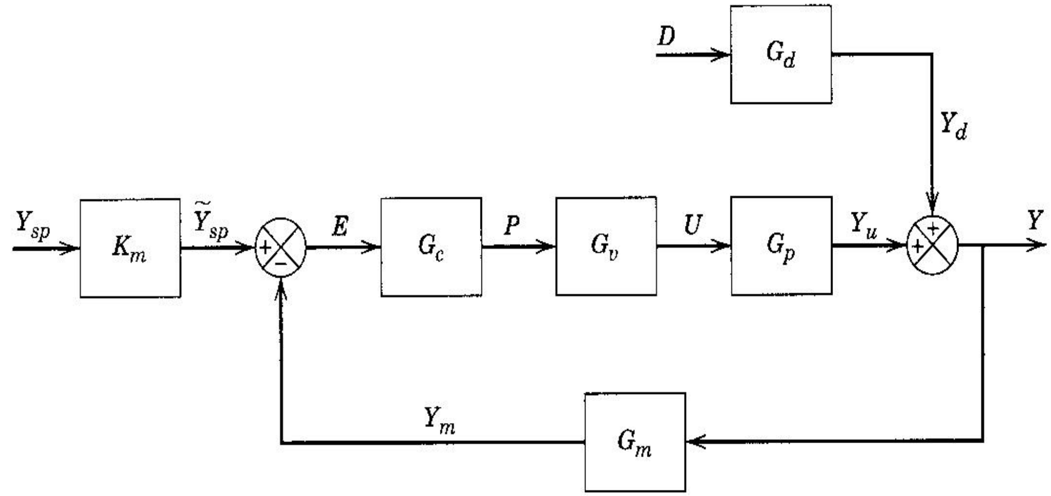
(2) List controlled variable, manipulated variable and possible disturbance variables.

(3) Should fail-close valve or fail-open valve be used to adjust S?

(4) Is the controller AC reverse acting or direct acting?

5

Consider a feedback control system:



$$G_p(s) = \frac{2}{(s+1)} \quad G_m(s) = \frac{1}{(s+3)} \quad G_v(s) = \frac{2}{(s+2)} \quad G_c(s) = k_c$$

Using Routh stability method to determine the range of *Kc* which makes the closed loop control system stable.