

2. Given the characteristic equation of a closed-loop control system,

$$s(s+2) + K(s+4) = 0$$

(a) Construct the root loci for $K \geq 0$. (15%)

(b) Find the value of K so that the system is stable from the root loci. (5%)

3. By assign $i(t)$ and $e_c(t)$ as state variables,

(a) Write the state equations. (6%)

(b) Draw a state diagram for the system. (6%)

(c) Find the transfer functions $\frac{I(s)}{E(s)}$ and $\frac{E_c(s)}{E(s)}$. (8%)

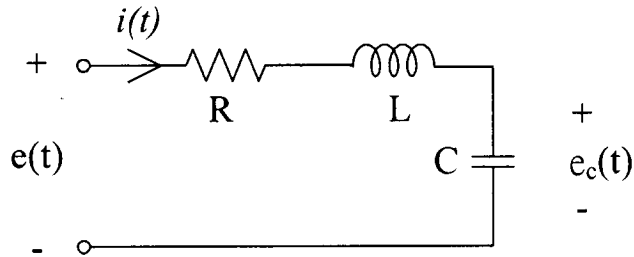


Figure 2

4. Given the characteristic equation of a closed-loop control system,

$$s^3 + 3s^2 + 10Ks + (10 + 20K) = 0$$

Apply the Routh-Hurwitz criterion to find the range of K so that the system is stable. (20%)

5. Determine the range of K so that value of maximum overshoot $\leq 5\%$. (20%)

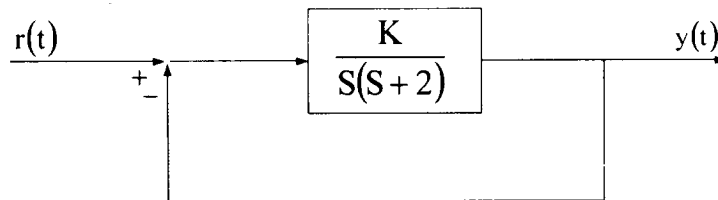


Figure 3