

Örnek: $\frac{d^2 y(t)}{dt^2} + 2 \frac{dy(t)}{dt} + 5y(t) = \frac{dX(t)}{dt} - X(t)$

Tüm başlangıç şartları sıfırdır. $X(t) = e^{-t} u(t)$ girişi için sistem çıkışı $y(t) = ?$

Denklemin Laplace dönüşümü alınır;

$$s^2 Y(s) + 2s Y(s) + 5Y(s) = sX(s) - X(s)$$

$$(s^2 + 2s + 5) Y(s) = (s-1) X(s)$$

$$X(s) = \mathcal{L}\{X(t)\} = \frac{1}{s+1}$$

$$Y(s) = \frac{s-1}{(s+1)(s^2+2s+5)}$$

* Kökler kompleks
Tablodaki yapılara benzetilmeli

$$\frac{A}{s+1} + \frac{Bs+C}{s^2+2s+5}$$

$$A = -1/2$$

$$B = 1/2$$

$$C = 3/2$$

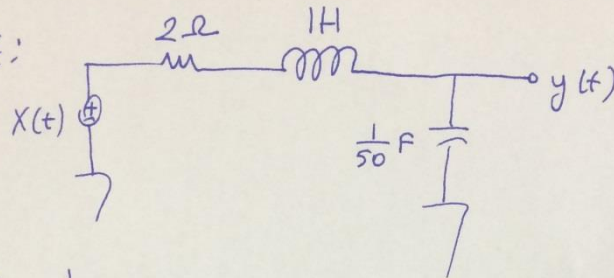
$$Y(s) = \frac{-1/2}{s+1} + \frac{1/2 s + 3/2}{s^2+2s+5}$$

$$Y(s) = \frac{-1/2}{s+1} + \frac{1}{2} \frac{s+3}{(s+1)^2+2^2}$$

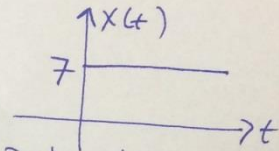
$$Y(s) = \frac{-1/2}{s+1} + \frac{1}{2} \frac{s+1}{(s+1)^2+2^2} + \frac{1}{2} \frac{2}{(s+1)^2+2^2}$$

$$y(t) = -\frac{1}{2} e^{-t} u(t) + \frac{1}{2} e^{-t} \cos 2t u(t) + \frac{1}{2} e^{-t} \sin 2t u(t)$$

Örnek:



Verilen devreye $x(t)$ işareti uygulandığında devre çıkışı $y(t) = ?$



Gerilim bölücü kuralından;

$$Y(s) = \frac{1/cs}{R + Ls + 1/cs} \cdot X(s)$$

$$x(t) = 7 \cdot u(t)$$

$$Y(s) = \frac{50/s}{2 + s + 50/s} \cdot X(s)$$

$$X(s) = 7/s$$

$$Y(s) = \frac{50}{s^2 + 2s + 50} \cdot \frac{7}{s} = \frac{350}{s(s^2 + 2s + 50)}$$

$$Y(s) = \frac{A}{s} + \frac{Bs + C}{s^2 + 2s + 50}$$

$$A = 7 \quad B = -7 \\ C = -14$$

$$Y(s) = \frac{7}{s} - \frac{7s + 14}{s^2 + 2s + 50} = \frac{7}{s} - \frac{7s + 14}{(s+1)^2 + 7^2}$$

$$Y(s) = \frac{7}{s} - 7 \frac{(s+1)}{(s+1)^2 + 7^2} - \frac{7}{(s+1)^2 + 7^2}$$

$$y(t) = 7u(t) - 7e^{-t} \cos 7t u(t) - e^{-t} \sin 7t u(t)$$