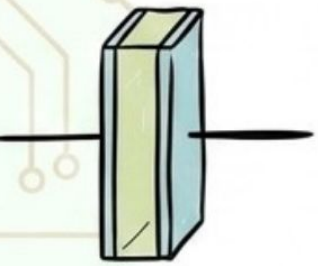
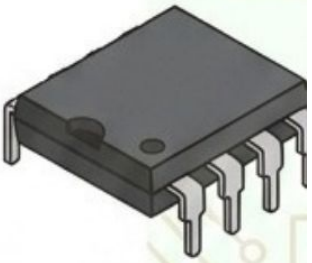
$$V = I * R$$



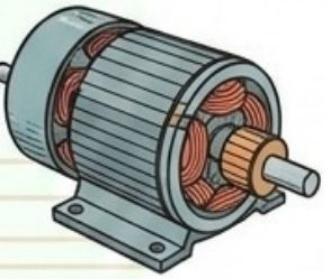
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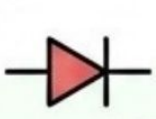
** EE 351 **















$$P = V * I * \cos(\varphi)$$

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ch 2

Modeling in the frequency domain

* Laplace transformation

$F(s)$	$f(t)$ $0 \le t$
1	$\delta(t)$ unit impulse at $t = 0$
$\frac{1}{s}$	1 or $u(t)$ unit step starting at $t = 0$
$\frac{1}{s^2}$	$t \cdot u(t)$ or t ramp function
$\frac{1}{s^n}$	$\frac{1}{(n-1)!}t^{n-1}$ n = positive integer
$\frac{1}{s}e^{-as}$	$u(t-a)$ unit step starting at $t = a$
$\frac{1}{s+a}$	e^{-at} exponential decay
$\frac{1}{(s+a)^n}$	$\frac{1}{(n-1)!}t^{n-1}e^{-at}$ n = positive integer
$\frac{1}{s(s+a)}$	$\frac{1}{a}(1-e^{-at})$
$\frac{\omega}{s^2+\omega^2}$	$\sin \omega t$
$\frac{s}{s^2+\omega^2}$	$\cos \omega t$

$t \longrightarrow s$ Laplace

$\longleftarrow$ inverse laplace

$s \rightleftharpoons \frac{d\delta(t)}{dt}$ ...

Example 6:

Find the inverse laplace for the following:

$$F(s) = \frac{s^3 + 2s^2 + 6s + 7}{s^2 + s + 5}$$

* solution *

يوجد غلط في السؤال
في البسط درجة وكلية
نفهم من السؤال طريقة
الحل

* درجة البسط لابد أن تكون أقل من درجة المقام كلية

المقام كلية ← s^2+s+5

$s+1$

$s^2+s+5 \;\big|\; s^3+2s^2+6s+7$

$-(s^3+s^2+5s)$

s^2+s+7

$-(s^2+s+5)$

2

$$\therefore F(s) = s+1 + \frac{2}{s^2+s+5}$$

$$\frac{2}{s^2+s+5} = \frac{2}{(s+1)(s+2)} = \frac{K_1}{(s+1)} + \frac{K_2}{(s+2)}$$

$$K_1 = \frac{2}{(S+2)}\Big|_{S=-1} = \frac{2}{-1+2} = 2$$

$$K_2 = \frac{2}{(S+1)}\Big|_{S=-2} = \frac{2}{-2+1} = -2$$

$\frac{1}{S+a} \rightleftharpoons e^{-at}$

$$\therefore F(S) = S+1 + \frac{2}{S+1} - \frac{2}{S+2}$$

$$\therefore f(t) = \frac{d\delta(t)}{dt} + \delta(t) + 2e^{-t} - 2e^{-2t}$$

~ * ~ * ~ * ~

Example: Find the inverse laplace for

$$F(S) = \frac{(S+1)^2}{S^2-S-6}$$

Solution

$$F(S) = \frac{(S+1)^2}{S^2-S-6} = \frac{S^2+2S+1}{S^2-S-6}$$

لابد

درجة البسط تساوي درجة المقام

$$S^2-S-6 \;\overline{)\; S^2+2S+1}$$

$$1$$

$$-(S^2-S-6)$$

$$3S+7$$

$$\therefore F(s) = 1 + \frac{3s+7}{s^2-s-6}$$

$$\frac{3s+7}{s^2-s-6} = \frac{3s+7}{(s-3)(s+2)} = \frac{K_1}{s-3} + \frac{K_2}{s+2}$$

$$K_1 = \left.\frac{3s+7}{s+2}\right|_{s=3} = \frac{3\times 3+7}{3+2} = 3.2$$

$$K_2 = \left.\frac{3s+7}{s-3}\right|_{s=-2} = \frac{3\times -2+7}{-2-3} = -0.2$$

$$\therefore F(s) = 1 + \frac{3.2}{s-3} - \frac{0.2}{s+2}$$

$$F(s) = 1 + 3.2\,\frac{1}{s-3} - 0.2\,\frac{1}{s+2}$$

$$\therefore f(t) = \delta(t) + 3.2\,e^{3t} - 0.2\,e^{-2t}$$