國立清華大學

It means

system
$y'' + py' + qy = f(t)$

But what we obtain is $\mathcal{L}\{y\}$ (=), that is, the response in

Product rule for inverse Laplace transform and convolution

We've seen "product of functions" in s-domain, generally expressed as We want to know

Q_1: what's the $\mathcal{L}^{-1}$ of the product

Q_2: what's the operation of $f(t)$ and $g(t)$ in t-domain to generate such

國立清華大學

Find $\mathcal{L}^{-1}\{F(s)G(s)\} = ?$

$$F(s)G(s) = \left(\int_0^\infty f(\tau)e^{-s\tau}d\tau\right)\left(\int_0^\infty g(u)e^{-su}du\right)$$

So, $\mathcal{L}^{-1}\{F(s)G(s)\} =$

This is called

Def: Convolution of $f(t)$ and $g(t)$

Ex: Use convolution to calculate $\mathcal{L}^{-1}\left\{\frac{1}{(s-1)(s+4)}\right\}$

Remarks:

① What is the meaning of "convolution of two functions"?

The idea of convolution can be

國立清華大學

ex: two discrete functions $f[n]$, $g[n]$