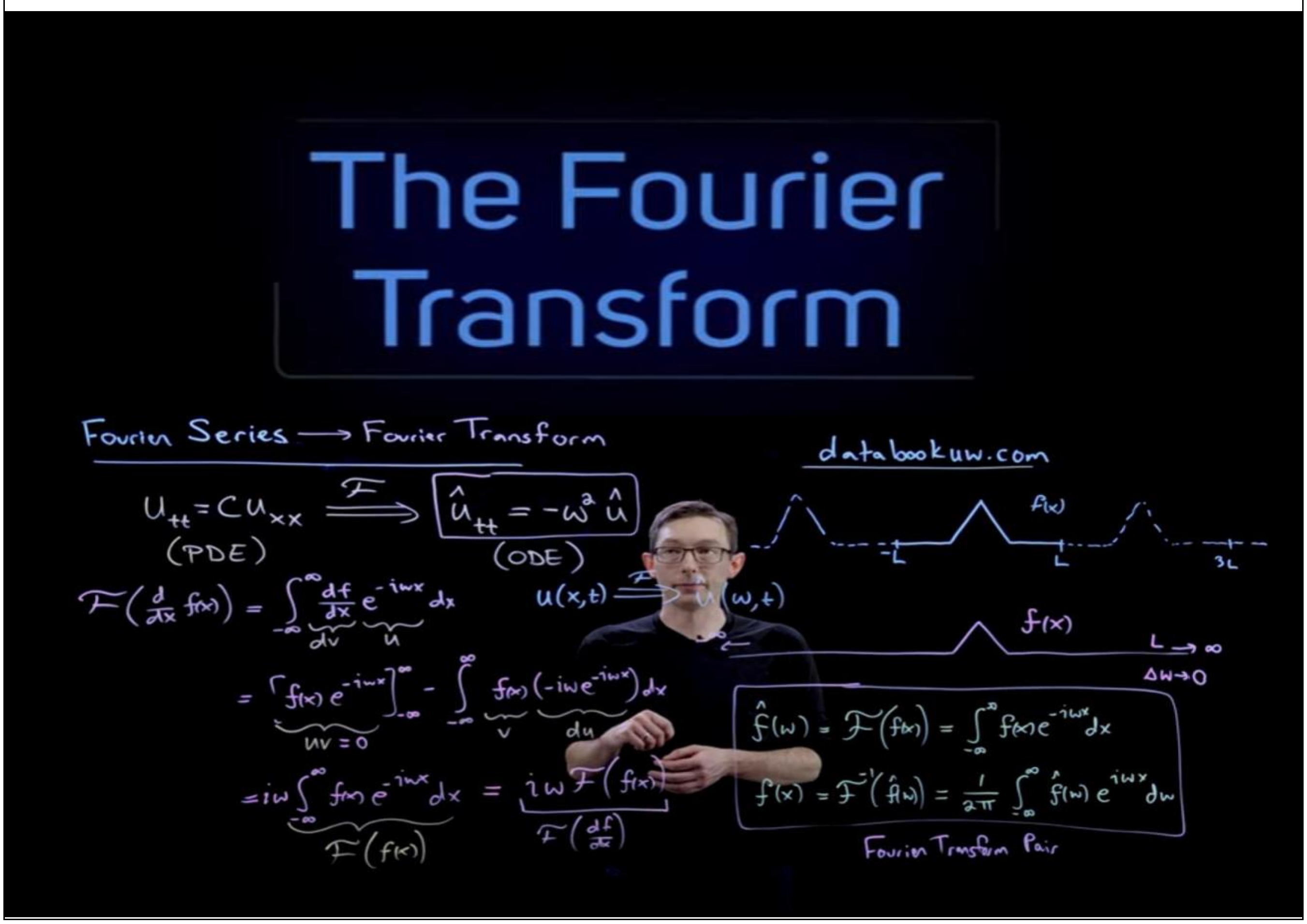
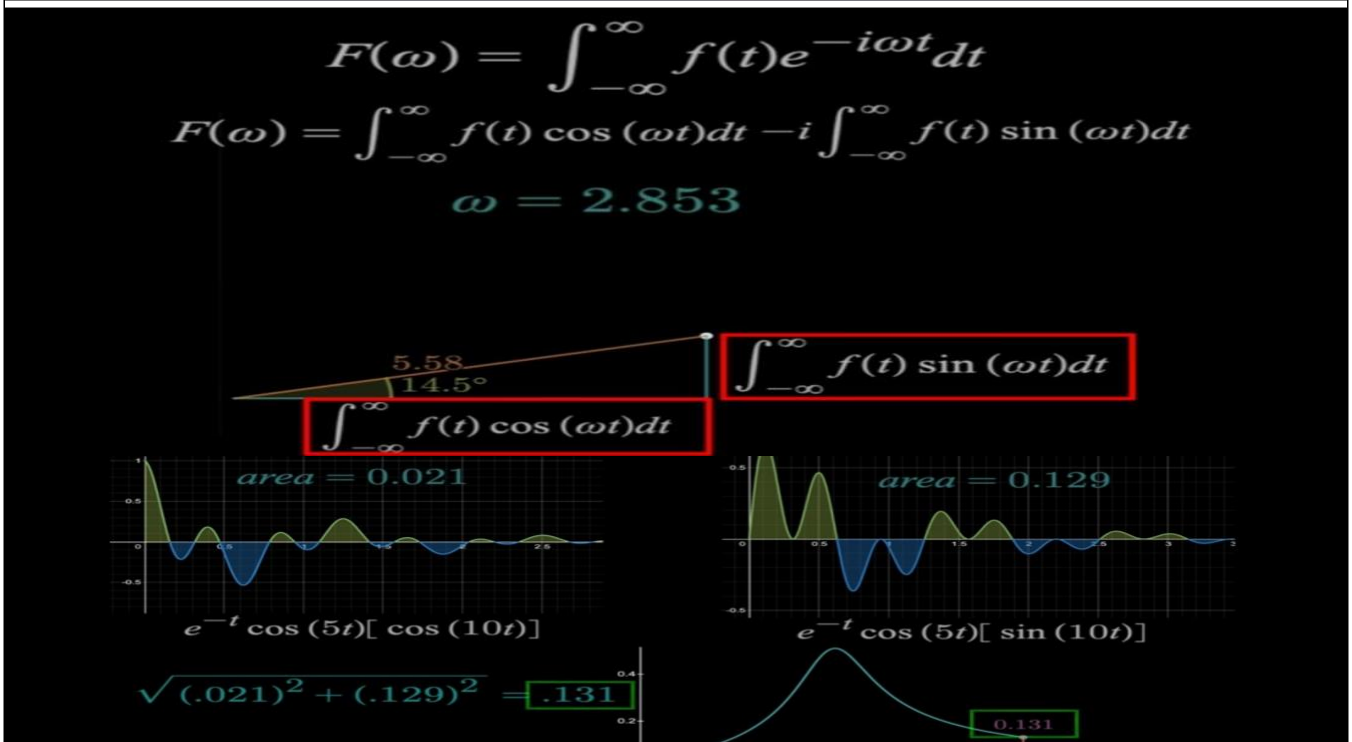
DAILY ASSESSMENT FORMAT

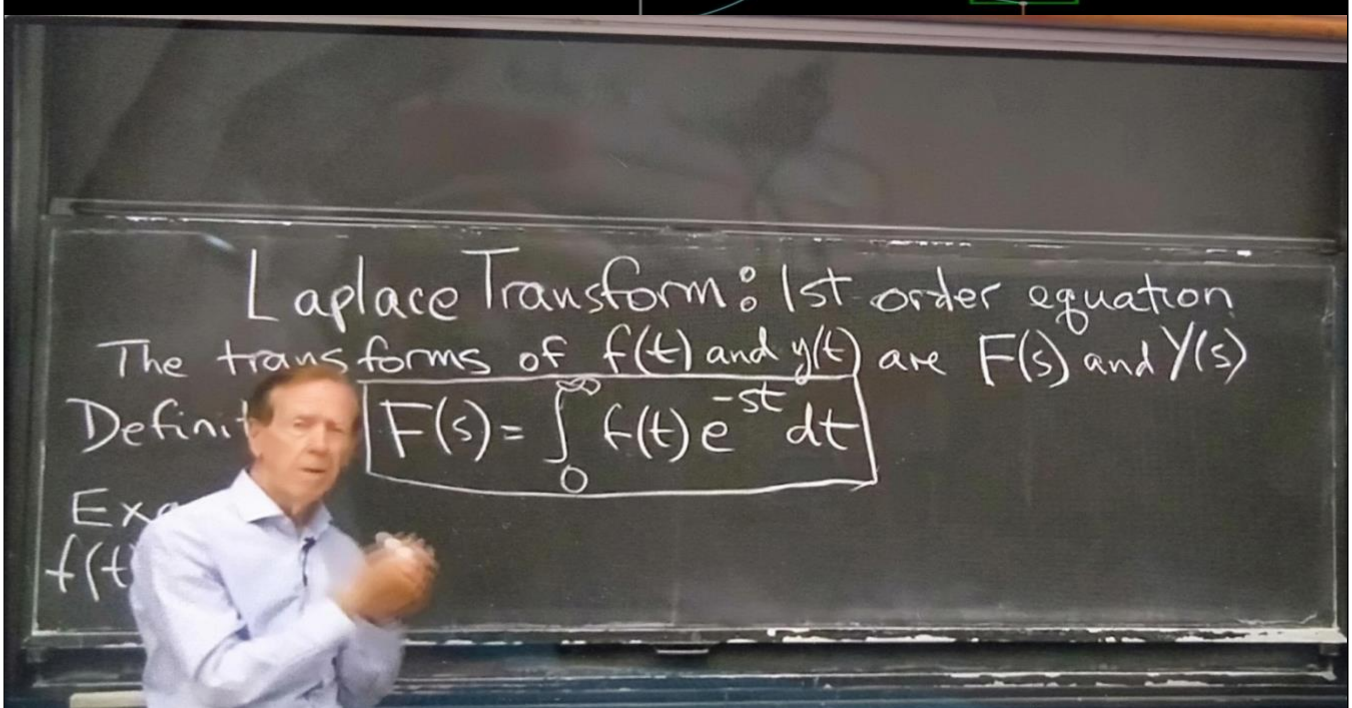
Date:	**26-05-2020**	**Name:**	**Sahana S R**
Course:	**Digital signal processing**	**USN:**	**4al17ec083**
Topic:	**•Fourier transform** **•Fourier transform and Derivatives** **•Fourier transform and Convolution integral** **•Transform and Laplace transform first order** **•Implementation of laplace transform using Matlab** **•Application of Z-Transform** **•Z-Transform of sequence using matlab**	**Semester & Section:**	**6^{th} sem** **B sec**
GitHub Repository:	**sahanasr-course**		

FORENOON SESSION DETAILS
Image of session




The Fourier Transform
and Convolution Integrals


$F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-i\omega t} dt$
$F(\omega) = \int_{-\infty}^{\infty} f(t) \cos(\omega t) dt - i \int_{-\infty}^{\infty} f(t) \sin(\omega t) dt$
$\omega = 2.853$
5.58
14.5°
$\int_{-\infty}^{\infty} f(t) \sin(\omega t) dt$
$\int_{-\infty}^{\infty} f(t) \cos(\omega t) dt$
$area = 0.021$
$area = 0.129$
$e^{-t} \cos(5t)[\cos(10t)]$
$e^{-t} \cos(5t)[\sin(10t)]$
$\sqrt{(.021)^2 + (.129)^2} = .131$
0.131


Laplace Transform: 1st order equation
The transforms of f(t) and y(t) are F(s) and Y(s)
$F(s) = \int_0^{\infty} f(t) e^{-st} dt$

Lec- 45

Applications of Z - transforms - I

Properties:

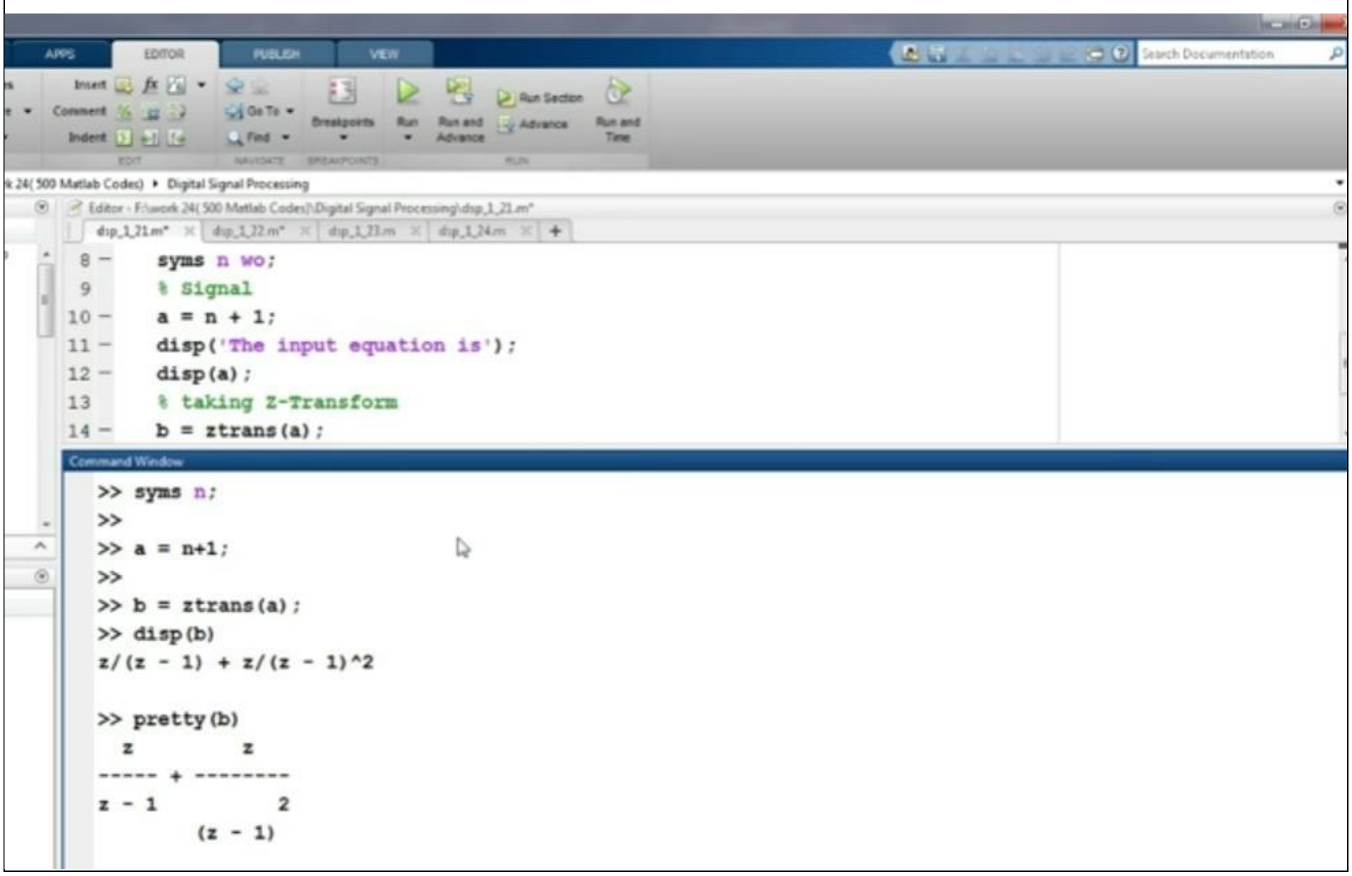
If $u_1(n)$, $u_2(n)$,. . . , $u_k(n)$ be k independent solutions of the equation $y_{n+k} + a_1\, y_{n+k-1} + . . . + a_k\, y_n = 0,$

then $\mathrm{U}_n = c_1\, u_1(n) + c_2\, u_2(n) + . . + c_k\, u_k(n),$

is called **complete solution**.

If V_n is a particular solution of equation (1), then the complete solution of (1) is $y_n = \mathrm{U}_n + V_n$.

The part U_n is called the complementary function and the part V_n is called the particular integral.



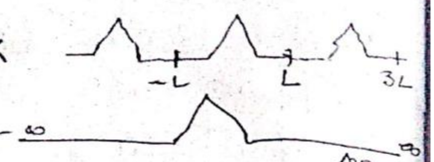
Report – Report can be typed or hand written for up to two pages.

Fourier Transform

$$W_L = \frac{K\pi}{L} = K\Delta w \qquad \Delta W = \frac{\pi}{L}$$

$$f(x) = \sum_{K=-\infty}^{\infty} C_K e^{iK\pi x/L}$$

$$C_K = \frac{1}{2\pi} \langle f(x)\, \psi_K \rangle = \frac{1}{2L}\int_{-L}^{L} \frac{f(x)\, e^{-jK\pi x/L}}{\psi_K}\, dx$$



$$f(x) = \lim_{\Delta w \to 0} \sum_{K=-\infty}^{\infty} \frac{\Delta w}{2\pi} \int_{-\pi/\Delta w}^{\pi/\Delta w} f(\xi)\, e^{-iK\Delta w}\, d\xi$$

$$= \int_{-\infty}^{\infty} \frac{1}{2\pi} \int_{-\infty}^{\infty} f(\xi)\, e^{-iw\xi}\, d\xi\, e^{iwx}\, dw$$

$$\hat{f}(w) = F(f(x)) = \int_{-\infty}^{\infty} f(x) e^{-iwx} dx$$

$$f(x) = F(\hat{f}(w)) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \hat{f}(w) e^{iwx} dw$$

Fourier Transform and Derivative

$$\underset{(PDE)}{U_{tt} = CU_{xx}} \Longrightarrow \underset{ODE}{\boxed{\hat{U}_{tt} = -w^2 \hat{U}}}$$

$$F\left(\frac{d}{dx} f(x)\right) = \int_{-\infty}^{\infty} \frac{df}{dx} e^{-iwx} dx$$

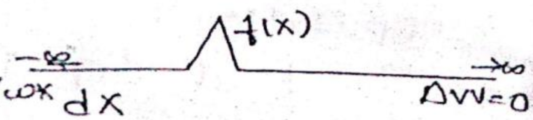
$$= f(x)\, e^{-iwx}\Big]_{-\infty}^{\infty} - \int_{-\infty}^{\infty} f(x)\left(-iw e^{-iwx}\right) dx$$

$$= iw \int_{-\infty}^{\infty} f(x)\, e^{-iwx} dx = iw\, F(f(x))$$

Fourier Transform and Convolution Integrals

$$(f * g) = \int_{-\infty}^{\infty} f(x-\xi)\, g(\xi)\, d\xi$$

Fourier Transform



$$\hat{f}(w) = F(f(x)) = \int_{-\infty}^{\infty} f(x) e^{iwx} dx$$

$$f(x) = F^{-1}(\hat{f}(w)) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \hat{f}(w)\, e^{iwx} dw$$

$$F(f * g) = F(f)\, F(g) = \hat{f}\, \hat{g}$$

$$F^{-1}(\hat{f}\hat{g})(x) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \hat{f}(w)\, \hat{g}(w)\, e^{iwx} dw$$

$$= \frac{1}{2\pi}\int_{-\infty}^{\infty} \hat{f}(w) \left(\int_{-\infty}^{\infty} g(y)\, e^{-iwy} dy\right) e^{iwx} dw$$

$$= \frac{1}{2\pi}\int_{-\infty}^{\infty} g(y) \int_{-\infty}^{\infty} \hat{f}(w)\, e^{iw(x-y)}\, dw\, dy$$

$$= f * g$$

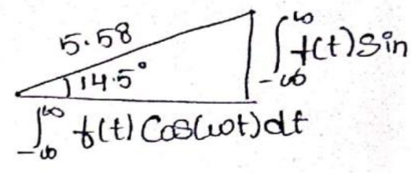
Intution of Fourier Transform & Laplace Transform

$$F(\omega) = \int_{-\infty}^{\infty} f(t)\, e^{-i\omega t}\, dt \qquad e^{i\omega t} = \cos(-\omega t) \pm i\sin(\omega t)$$

$$F(\omega) = \int_{-\infty}^{\infty} f(t)\cos(\omega t)\,dt - i\int_{-\infty}^{\infty} f(t)\sin(\omega t)\,dt$$

$\omega = 2.853$

Fourier: $F(\omega) = \int_{-\infty}^{\infty} f(t)\, e^{-i\omega t}\, dt$



Laplace: $F(s) = \int_{0}^{\infty} f(t)\, e^{-(\alpha + i\omega)t}\, dt$

$$F(s) = \int_{0}^{\infty} f(t)\, e^{-i\omega t} e^{-\alpha t}\, dt$$

Transform and Laplace Transform first order

$$F(s) = \int_{0}^{\infty} f(t)\, e^{-st}\, dt$$

Eg: $F(s) = \int_{0}^{\infty} e^{at} e^{-st}\, dt = \left[\dfrac{e^{(a-s)t}}{a-s}\right]_0^{\infty} = \dfrac{1}{s-a} = F(s)$

Implementation of Laplace Transform using matlab

Application of Z-Transform

$$y_{n+1} + y_n = 2$$

$$\Delta f(x) = f(x+h) - f(x)$$

$$\Delta y_{n+1} = y_{n+2} - y_{n+1}$$

$$\Delta y_{n+1} + y_n = 2.$$

$$y_{n+2} - y_{n+1} + y_n = 2.$$

$$\Delta y_{n+1} + \Delta^2 y_{n-1} = 1$$

$$y_{n+2} - y_{n+1} + \Delta(\Delta y_{n-1}) = 1$$

$$y_{n+2} - y_{n+1} + y_{n+1} - 2y_n + y_{n-1}$$

Find the Z-Transform of Sequence using Matlab