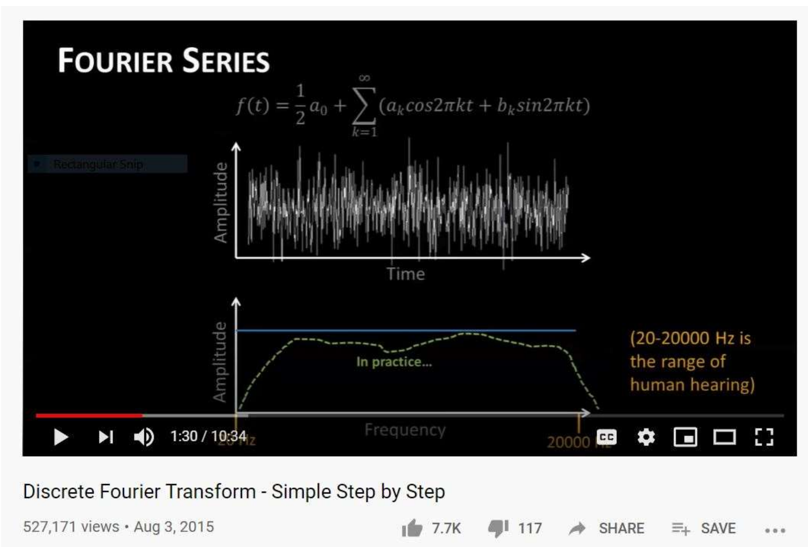
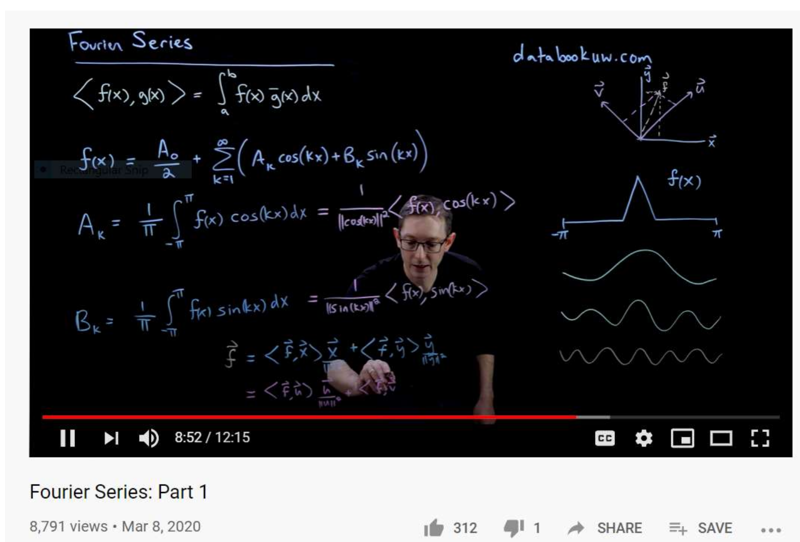
DAILY ASSESSMENT FORMAT

Date:	**22/05/2020**	**Name:**	**Sachin Krishna Moger**
Course:	**Digital Signal Processing**	**USN:**	**4AL17EC103**
Topic:	**Introduction to Fourier Series & Fourier Transform**	**Semester & Section:**	**6-B**
Github Repository:	**Sachin-Courses**		

FORENOON SESSION DETAILS





Fourier series AfundamentalresultinFourieranalysisisthatiff(x)isperiodicandpiecewise smooth, then it can be written in terms of a Fourier series, which is an infinite sum of cosines and sines of increasing frequency. In particular, if f(x) is 2πperiodic, it may be written as:

$$f(x) = \frac{a_0}{2} + \sum_{k=1}^{\infty} \left(a_k \cos(kx) + b_k \sin(kx)\right).$$

FOURIER SERIES AND FOURIER TRANSFORMS
The coefficients ak and bk are given by

$$\begin{aligned} a_k &= \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \cos(kx) dx \\ b_k &= \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \sin(kx) dx, \end{aligned}$$

which may be viewed as the coordinates obtained by projecting the function ontotheorthogonalcosineandsinebasis{cos(kx),sin(kx)}∞ k=0. Inotherwords, the integrals in (2.6) may be re-written in terms of the inner product as:

$$\begin{aligned} a_k &= \frac{1}{\|\cos(kx)\|^2} \langle f(x), \cos(kx) \rangle \\ b_k &= \frac{1}{\|\sin(kx)\|^2} \langle f(x), \sin(kx) \rangle, \end{aligned}$$

where kcos(kx)k2 = ksin(kx)k2 = π. This factor of 1/π is easy to verify by numerically integrating cos(x)2 and sin(x)2 from−π to π. The Fourier series for an L-periodic function on [0,L) is similarly given by:

$$f(x) = \frac{a_0}{2} + \sum_{k=1}^{\infty} \left(a_k \cos\left(\frac{2\pi kx}{L}\right) + b_k \sin\left(\frac{2\pi kx}{L}\right)\right),$$

with coefficients ak and bk given by

$$\begin{aligned} a_k &= \frac{2}{L} \int_0^L f(x) \cos\left(\frac{2\pi kx}{L}\right) dx \\ b_k &= \frac{2}{L} \int_0^L f(x) \sin\left(\frac{2\pi kx}{L}\right) dx. \end{aligned}$$

Fourier series approximation to a hat function.

```
% Define domain dx = 0.001;
L = pi;
 x = (-1+dx:dx:1)*L;
n = length(x);
nquart = floor(n/4);
% Define hat function f = 0*x;
 f(nquart:2*nquart) = 4*(1:nquart+1)/n;
 f(2*nquart+1:3*nquart) = 1-4*(0:nquart-1)/n;
plot(x,f,'-k','LineWidth',1.5), hold on
% Compute Fourier series CC = jet(20);
A0 = sum(f.*ones(size(x)))*dx;
fFS = A0/2;
for k=1:20 A(k) = sum(f.*cos(pi*k*x/L))*dx;
 % Inner product B(k) = sum(f.*sin(pi*k*x/L))*dx;
fFS = fFS + A(k)*cos(k*pi*x/L) + B(k)*sin(k*pi*x/L);
plot(x,fFS,'-','Color',CC(k,:),'
LineWidth',1.2)
```