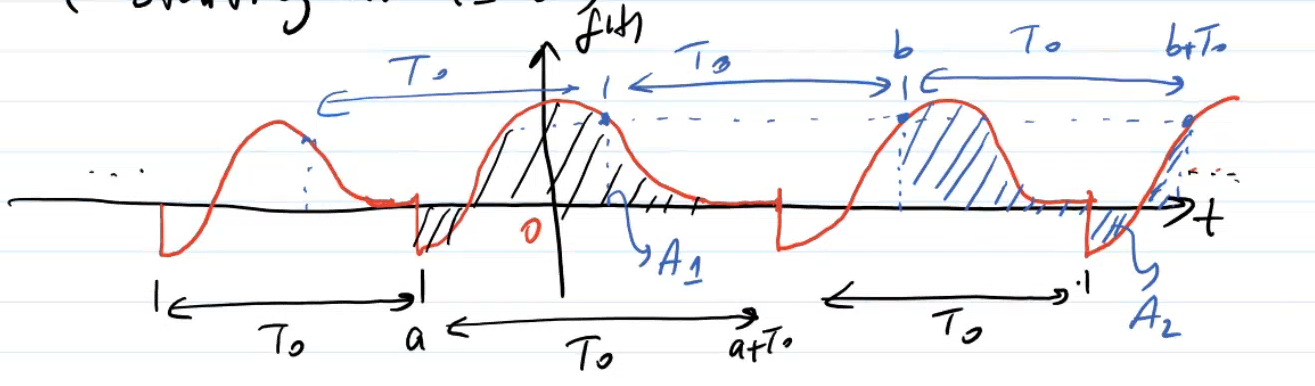
Trigonometric Fourier Series

A signal f(t) is periodic if f(t) = f(t + T0), for all t.

The smallest value of T0 satisfying the periodicity condition is the period of the f(t).

A periodic signal must be an everlasting signal (starting at t = -)



f(t) can be generated by periodic extension of any segment of f(t) of duration T0.

The area under f(t) over any interval of duration T0 is the same

Text, letter

Description automatically generated

Fourier Series is applied to periodic signal.

A sinusoid,

Text, letter

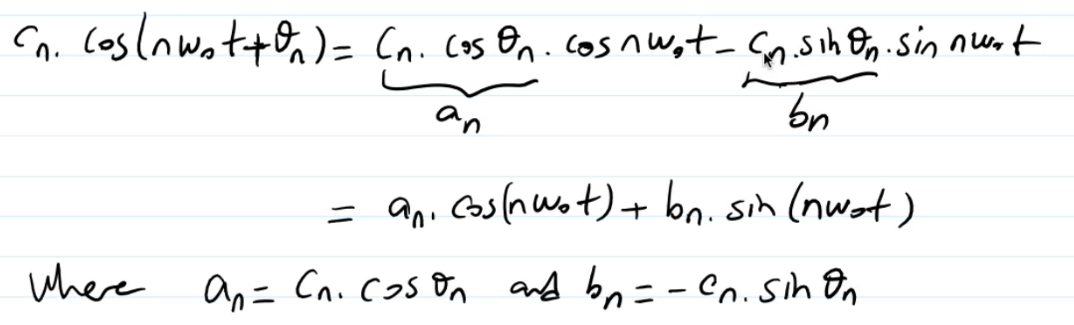
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Let us consider,

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f(t) is periodic signal.

We can express a sinusoid Text

Description automatically generated in terms of sines and cosines.

Text, letter

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Unknown coefficients are red ones. We try to find them.

Text, letter

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Text, letter

Description automatically generatedComputing the coefficients of a Fourier Series:

Integrations are over one period.

The Fourier Spectrum – Visualization of your result – How we visualize fourier series into figures:

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Fourier spectrum consists of 2 figures – fig 1 and fig 2. Combination of these 2 is called fourier spectrum.

Cn 🡪 amplitude (y-axis)

w 🡪 frequency

🡪 phase

Example:

A picture containing letter

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Text, letter

Description automatically generated

We start from regular trigonometric fourier series then move to the compact trigonometric fourier series.

Graphical user interface, text

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Text, letter

Description automatically generated

For and bn, n is from 1 to infinity.

We need compact trigonometric fourier series.

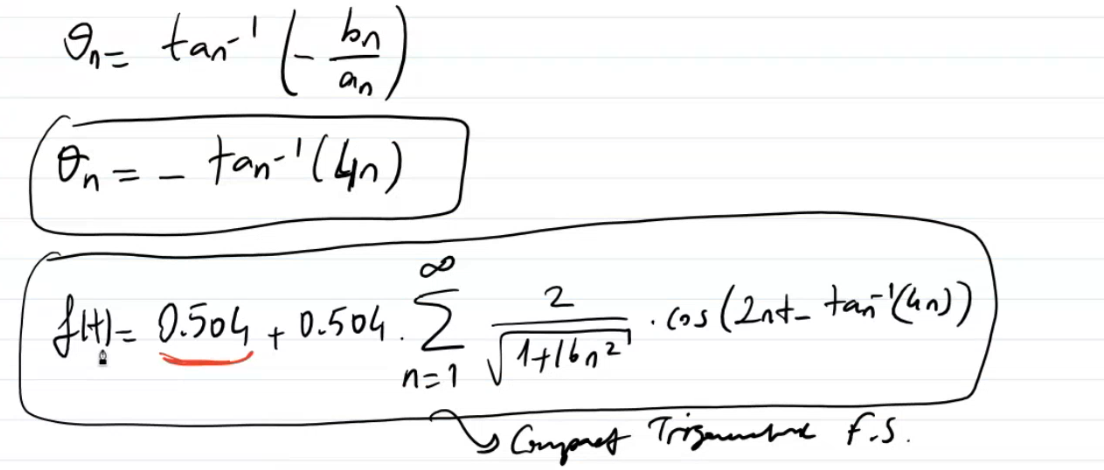
Text, whiteboard

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Diagram

Description automatically generated



Chart, line chart

Description automatically generated

For n = 1, w = 2. 🡪 w0 = 2/T0 = 2/ = 2 🡪 n.w0 = 2n = nth harmonic

For n = 2, w = 4; for n = 3, w = 6, …

Chart, line chart

Description automatically generated

starts from n = 0. As we increase w, it starts to approximate to -/2 = -90o

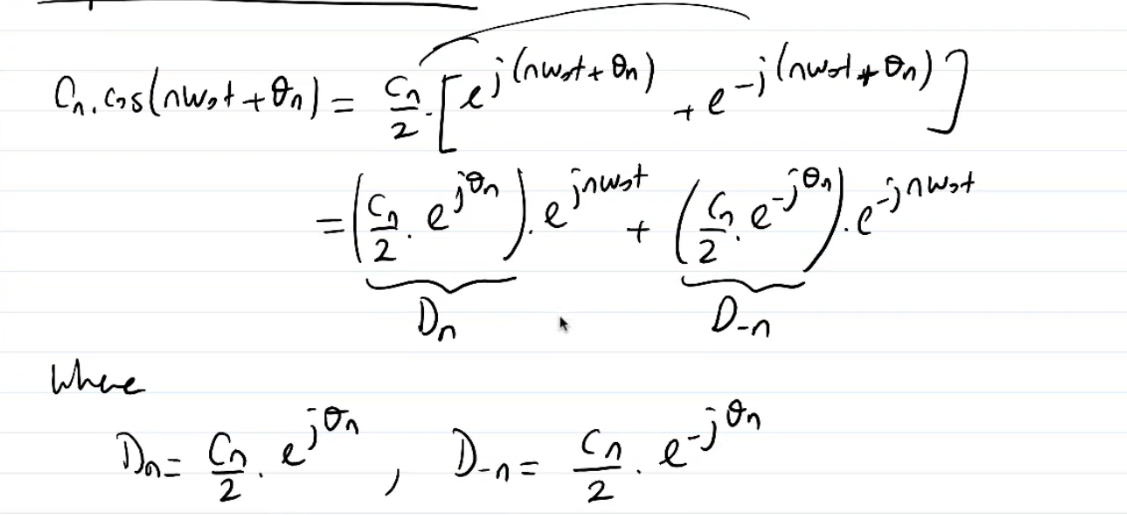
We can write down in terms of equation (blue smiling face equation):

Text, whiteboard

Description automatically generated

Exponential Fourier Series

Sinusoid in terms ıf compact trigonometric





cos can be written down in terms of exponential.

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Dn and D-n are symmetric. So we combined them.

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Description automatically generated

Example:

Line chart

Description automatically generated with medium confidence

Graphical user interface, text, application

Description automatically generated with medium confidence

?

n =

We have to find Dn and w0.

Text, letter

Description automatically generated

Text, letter

Description automatically generated

A picture containing text, sky, flock, slope

Description automatically generated

Spectrum:

Text, letter

Description automatically generated



Red line 🡪 Convert to polar form.

< kinda sign is phase information.

Chart, scatter chart

Description automatically generated



See that |Dn| is symettric for – and + values.

It is converging to = 900 when it goes to -, it is converging to - = -900 when it goes to .

See symmetry in both amplitude and phase spectrum.