EE313 Lecture 13

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Recall definition of CTFS:
Synthesis equation:
$x(t) = \sum a_n \cdot e^{jkw_0t}$

And analysis equation $x(t) \to a_k$:
$\frac{1}{T}\int_{-T}^{T} x(t) \cdot e^{-jk\cos tdt}$
Conditional convergence of series can be rearranged to sum to any number (Reimann's theorem)

Understand absolute and conditional convergence

Example:
Square pulse
$\begin{cases} 1 & |t| < T_1 \\ 0 & T_1 < |t| < \frac{T}{2} \end{cases}$
Find Fourier coefficients $a_k = \frac{1}{T}\int_{-T_1}^{T_1} x(t) \cdot e^{-jk\cos tdt}$.
Find (DC coefficient):
$a_0 = \frac{1}{T}\int_{-T_1}^{T_1}(1)\cdot(1)dt = \frac{2T_1}{T}$.
Find a_1:
...
$a_k = \frac{1}{T}\frac{-1}{jkw_0}[e^{-jkw_0T_1} - e^{+jkw_0T_1}]$
Use tricky Euler magic to get:
$= \frac{1}{T}\frac{2}{kw_0} \cdot \sin(kw_0T_1)$
$= \frac{2T_1}{T}$
Note that the resultant transform is $a_k = sinc[k]$ and $k \in \mathbb{Z}^+$ such that $k = \frac{T}{2T_1} \to a_k = 0$.

Heisenberg Uncertainty Principle
$P(s)$ =probability of particle at position$s, s \in \mathbb{R}.FP$ =probability of momentum.

Properties of Fourier

Linearity f, g, x+g, af+bg (Why?)

Time Shift $x(t), a_k$ $y(t) = x(t-t_0)$ shift by t_0 (phase shift) $x(t-t_0) \xrightarrow{phaseshift} e^{-jkw_0t_0} \cdot a_k$. (Why? Prove it.)