Lec01 : Fourier series.

EE261 : Fourier transform

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* We will start with fourier series, and use them as a transition to fourier transform.
* Fourier Series as almost identified with the study of Periodic phenomenon.
* Fourier series identified with mathematical analysis of periodic phenomenon.

* Fourier transform can be used as limiting case of Fourier series, it has to do with a study of mathematical analysis of Non-Periodic Phenomenon.

* Fourier transform as a limiting case of Fourier series, is concerned with analysis of non-periodic phenomenon.

* Same ideas carry over back and forth, some don't Sometime's they are simillar, and sometimes they are not. in Both cases there are two kind of inverse problem's Analysis, sythesis.

Analysis	Sythesis
① Analysis has to do with taking a signal / Function and Breaking it up into its constituent Parts and you hope the constituent parts are simpler – Break up a signal into simpler Constituent Parts	① reassembing a function with constituent parts two thing's go together

* The other thing to realize about both of these Procedure's, Analysis and sythesis is that they are accomplished by Linear operation's (Series and integral's

are always involved)

* This is one of the reason why the subject is so Powerful, Because there is such a Body of knowledge and such a deep and advanced understanding of Linear Operation's, linearity.

Linear operation's : integral's & series.

Fourier analysis is a Part of study of Linear system's.

Often here that fourier analysis is Part of Study of "Linear system's."

Fourier series, and its analysis of Periodic Phenomenum.

* The study of Periodic phenomenon is for us the mathematic's, science and Engineering of regullarly repeating Phenomenum. There is some Pattern that repeats and it repeats regullarly.

* we often see Periodic Phenomenom often either Periodicity in time (Eg: Pendulum) or Periodicity in space

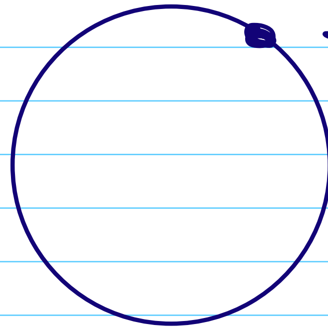
* There is often a Physical Quantity that we are measuring that is living on some Object in space (1-D, 2-D) that is symmetric (repeating quantity)

* Periodicity arises form symmetry.

<u>Ex:</u> distribution of heat on a circular ring.

Physical quantity: Temperature

ring is symmetry



temp at points on the ring.

* Periodic in spatial variable.

* Fourier analysis is often associated with question's of symmetry.

* Periodicity in time, we often use "frequency" word. Number of cycle's in a second.

* Periodicity in space, we use Period. that is physical measurement of How long the pattern is before repeat's. (Ex: Length, any quantity that repeat's)

* two Notion's come together in wave motion.

Again freq & wavelength

↓ Prediocity in time

↓ Periodicity in space.

Cycles | sec

* freq:- Number of times that the phenome-non comes to you in a sec

* Period:- you come to the phenomenon

Reciprocal Relationship:

there is Reciprocal Relationship b/w freq and wavelength.

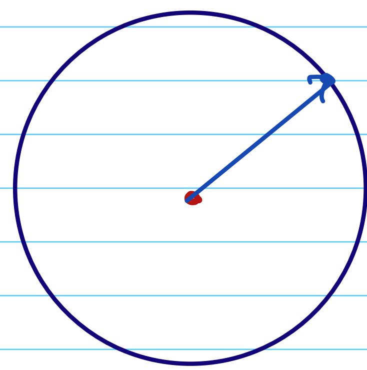
$$\lambda \vartheta = v$$

* Math comes in because there are simple mathematical function's that are Periodic / repeat's, so can be use to model Periodic phenomenons

cos t, sin t are Periodic of Period 2π. ie

$$\begin{pmatrix} \cos(2\pi+t) = \cos t \\ \sin(2\pi+t) = \sin t \end{pmatrix}$$

because sin t, cos t are Associated with Periodicity in space



$(\cos t, \sin t)$

$= [\cos(2\pi+t), \sin(2\pi+t)]$

$$\cos(t+2\pi n) = \cos t$$
$$\sin(t+2\pi n) = \sin t \qquad n = 0, \pm 1, \pm 2, \ldots$$

These simple function: sin, cos can be used to model the most complex behavior

Such simple function, sin & cos can be used to model the most complex behaviour. That is the fundamental discovery, OF Fourier series. BASIS of Fourier Analysis