

class: B.Tech 2nd yr ECE
Sub: Signal & System
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Topic: Eigenfunction

Eigen function: In Mathematics an eigenfunction of a linear operator "D" defined on some function space ~~of that~~ is any non zero function "f" in that space that when acted upon by "D", is only multiplied by some scaling factor called an "eigen value". As an

equation, this condition can be written as:

$$Df = \lambda f$$

for some scalar eigenvalue λ .

The solutions to this equation may also be subject to boundary conditions that limit the allowable eigenvalue and eigenfunctions.

An eigenfunction is a type of eigenvalue. Because of the boundary conditions the possible value of λ are generally limited for example to a discrete set $\lambda_1, \lambda_2, \dots$ or to a continuous set over some range.

The set of all possible eigenvalues of D is sometimes called its spectrum which may be discrete, continuous or combination of both.

Derivative Example:

For example, consider the derivative operator $\frac{d}{dx}$ with

eigenvalue equation

$$\frac{d}{dt} f(t) = \lambda f(t)$$

This differential equation can be solved by multiplying both sides by $\frac{dt}{f(t)}$ and

integrating its solutions. The exponential function

$$f(t) = f_0 e^{\lambda t}$$

is the eigenfunction of the derivative operator where f_0 is a parameter that depends on the boundary condition

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