



Some more applications on Fourier analysis in the field of science and technology

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ABSTRACT: In this paper we have discussed some extension of applications for Fourier analysis in the field of science and technology. In science and engineering, expanding functions in terms of sines and cosines which are useful to represent the analytically. In particular, the fields of electronics, mechanics, and signals and systems, electrostatics will make a very heavy use of Fourier analysis.

I. INTRODUCTION

In 1822 J.B Fourier Published a very use full tool for complex periodic function can be analysed. The theorem states that every complex periodic function $f(x)$ can be represented as a sine and cosine series in the form of

$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$$

The function satisfies the two conditions such as Dirichlet conditions,

Any periodic waveform of period $p = 2L$, can be expressed in a Fourier series provided that

- (a) it has a finite number of discontinuities within the period $2L$;
- (b) it has a finite average value in the period $2L$;
- (c) it has a finite number of positive and negative maxima and minima.

Evaluation of the coefficients of Fourier series

To evaluate the Fourier coefficients such as a_0 , a_n and b_n in the interval 2π is given by

$$a_0 = \frac{1}{\pi} \int_{-\pi}^{+\pi} f(x) dx$$

$$a_n = \frac{1}{\pi} \int_{-\pi}^{+\pi} f(x) \cos nxdx$$

$$b_n = \frac{1}{\pi} \int_{-\pi}^{+\pi} f(x) \sin nxdx$$

II. FOURIER ANALYSIS APPLICATIONS

1. Fourier series is broadly used in telecommunications system, for modulation and demodulation of voice signals, also the input, output and calculation of pulse and their sine or cosine graph.
2. This application is important not only for practical reasons (PDEs are important for physics), initially motivated Fourier series.
3. The Fourier series of functions in the differential equation often gives some prediction about the behaviour system of Differential equation and its solution.
4. advanced noise reduction in mobile cell phone network technology uses Fourier series where digital filtering is used to minimize noise and its bandwidth.



ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 3 , March 2021

5. Fourier Transform infra-red and FT-Raman spectroscopy, nuclear magnetic resonance (a basic tool in chemistry but more familiar in medicine via MRI imaging), and x-ray diffraction from crystals, the ultimate tool for determining molecular structure.
6. One use is to express the definitiveness of Heisenberg uncertainty.
7. The Fourier transform is important in mathematics, engineering, and the physical sciences.
8. It is a best tool that breaks a waveform (a function or signal) into an alternate representation, characterized by sine and cosines.
9. Some of the typical application of Fourier series. The problems which we study is that of a differential equation with a periodic function. The differential equation chosen models a lightly damped vibrating system.
10. With the use of different properties of Fourier transforms along with Fourier sine transform and Fourier cosine transform, one can solve many important problems of physics with very simple way.
11. There are many linear circuits used in Electronic engineering field .These circuits include various components like capacitor, inductor ,resistor etc. Every Electronic circuit can be modelled using mathematical differential equations can be solved using Fourier analysis .

Fourier transform is one of the mathematical tool that breaks a function, a signal or a waveform into an another representation which is characterized by sine and cosines.

REFERENCES

- [1].B.V.Ramana, Higher Engineering Mathematics,Tata Mc-Graw Hill Publication
- [2] H.K.Dassn” Advanced Engineering Mathematics”S.Chand & company Limited, New Delhi, 2009.
- [3] A. D. Poularikas, The Transforms and Applications Hand-book (McGraw Hill, 2000), 2nd ed.
- [4] M.J.Roberts, Fundamentals of Signals and Systems (Mc-Graw Hill, 2006), 2nd ed.
- [5] K. Riess, American Journal of Physics 15, 45 (1947).
- [6] M. N. S. Charles K. Alexander, Fundamentals of Electric Circuits (McGraw Hill, 2006), 2nd ed.