Recent Application of Fourier Transform In Medical Engineering

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Abstract: **Fourier transforms is one of the oldest and most well-known techniques in signal processing. This transform method represents signals as a summation of complex exponentials. Fourier analysis has been used in digital image processing for analysis of a single image as a two-dimensional wave form, and many other field like Quantum mechanics , Signal processing, Image Processing and filters, Transformation, representation, and encoding, Data Processing and Analysis and many other fields. This paper review the strength of Fourier transform in recent research in the field of medical engineering.**

Keywords **- Fourier transforms, Medical Engineering.**
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I. INTRODUCTION

Fourier transforms is one of the oldest and most well known techniques in signal processing. This transform method represents signals as a summation of complex exponentials. Fourier analysis, also termed spectral analysis or Harmonic analysis, decomposes a time-dependent periodic phenomenon into a series of sinusoidal functions, each defined by unique amplitude and phase values. Fourier transform convert complex curve into sum of a series of cosine waves (terms) and an additive term [1]. Each wave is defined by unique amplitude and a phase angle, where the amplitude value is half the height of a wave, and the phase angle (or simply, phase) defines the offset between the origin and the peak of the wave over the range 0 to 2π. Each term designates the number of complete cycles completed by a wave over the defined interval. Successive harmonic terms are added to produce a complex curve and each component curve, or term, accounts for a percentage of the total variance in the original complex curve [1]. Fourier analysis has been used in digital image processing for analysis of a single image as a two-dimensional wave form, and more recently more recently has been used for magnetic resonance imaging, angiographic assessment, automated lung segmentation & image quality assessment and Mobile stethoscope. In this paper we will review the recent application of Fourier transform in medical engineering

II. FOURIER TRANSFORM IN MEDICAL ENGINEERING

M. Guerquin-Kern et.al [2] has used Fourier transform for analytical simulation tools that are suited to parallel magnetic resonance imaging and allow one to build realistic phantoms. This paper introduces analytical simulation tools that are suited to parallel magnetic resonance imaging and allow one to build realistic phantoms. The proposed phantoms are composed of ellipses and regions with piecewise-polynomial boundaries, including spline contours, Bézier contours, and polygons. In addition, they take the channel sensitivity into account, for which we investigate two possible models. Analytical formulations provide well defined data in both the spatial and k-space domains. Their main research is the closed-form determination of the Fourier transforms.

Tobias Benz et.al [3] has used Fourier-based approach to the angiographic assessment of flow diverter efficacy in the treatment of cerebral aneurysms. In this article they propose a metric for the angiographic assessment of flow diverter deployments in the treatment of cerebral aneurysms. By analyzing the frequency spectra of signals derived from digital subtraction angiography (DSA) series, the metric aims to quantify the prevalence of frequency components that correspond to the patient specific heart rate. For estimating the power spectral density (PSD) of a time-contrast curves (TCC), the periodogram estimator was used, which is a PSD estimator based on the discrete Fourier transform (DFT).

JIE WEI et.al [4] used Fourier transform for automated lung segmentation and image quality assessment for clinical 3-d/4-d-computed tomography. In this paper, they applied ideas and algorithms from image/signal processing, computer vision, and machine learning to 4DCT lung data so that lungs can be reliably segmented in a fully automated manner, lung features can be visualized and measured on the fly via user interactions, and data quality classifications can be computed in a robust manner. They developed two different approaches to automatically analyze 4-D-computed tomography images and produce numeric indicators measuring their quality in batch mode: first approach use Fourier analysis technique.

D. Chamberlain et.al [5] uses Fourier transform for Mobile stethoscope and signal processing algorithms for pulmonary screening and diagnostics. In this research a low-cost stethoscope and smart phone application to record lung sounds. We discuss problems we encountered with the initial design and demonstrate an improved design that is currently being used in the field. We also demonstrate an algorithm capable of automatic detection of wheeze sounds. The automatic wheeze detection algorithm uses time-frequency analysis and the Short Time Fourier Transform to identify sections of wheezing in recorded lung sound files.

III. CONCLUSION:

Fourier transform which is also frequency domain representation / time series analysis proved its application in Quantum mechanics , Signal processing, Image Processing and filters, Transformation, representation, and encoding, Data Processing and Analysis and many other fields. In this paper showed that Fourier transform can also be successfully applied in the field of medical engineering hence some more research yet to be explored.

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