Dheeraj el at. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 4, Issue 1, March 2017, pp. 23-24

Review: Design of FIR Filters with Arbitrary Amplitude and Phase Specifications using Optimization Technique

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***Abstract*: Digital Signal Processing is one of the most powerful technologies that are shaping science and engineering in the twenty-first century. Revolutionary changes have already been made in a broad range of fields: communications, medical imaging, radar and sonar, and high fidelity music reproduction, to name just a few. Each of these areas has developed a comprehensive DSP technology, with its own algorithms, mathematics, and specialized techniques. The digital filters are an essential part of DSP. In fact, their extraordinary performance is one of the key reasons that DSP has become so popular. The purpose of the filters is to allow some frequencies to pass unaltered, while completely blocking others. The digital filters are mainly used for two purposes: separation of signals that have been combined, and restoration of signals that have been distorted in some way.**

***Keyword* – FIR filter, Matlab.**

I. INTRODUCTION

Digital signal processing is the mathematics, the algorithms and the techniques for analyzing and modifying a signal to optimize or improve its performance or efficiency. It is a type of signal processing performed by digital means with digital signal processor or a similar device that can execute DSP specific processing algorithms. It involves applying a number of algorithms to both analog and digital signals to generate a new signal, which has better characteristics than the original signal. Typically DSP first converts signal into a digital signal with an analog to digital convertor by sampling, quantization. However if the output required is analog then a digital to analog convertor is used. DSP is one of the most powerful tools that will shape the science and engineering in this century as it has a major and increasing impact in many key areas of technology.

Revolutionary changes have been already made in different range of fields including communications, medical imaging, radar and sonar, reproduction, oil prospecting etc. It has a number of advantages especially in reliability, repeatability, versatility, upgradability and flexibility, high noise immunity, low sensitivity to temperature changes and component tolerances. It also reduces noise susceptibility, development time, chip count, cost, and power consumption.

II. FILTER DESIGN TECHNIQUES

DSP means digital signal processing it is an area of science and engineering that has rapidly developed over the past 30 years this rapid development is a result of advancement in computer technology and integrated circuits fabrication. Therefore, many of signal processing tasks that were performed by using analog means are realized by digital hardware . Signal processing is a method of extracting information from the signal. Thus signal processing is concerned with representing signals in mathematical terms and extracting the information. The information contained in the signal can also be extracted either in original domain or in some other transformed domain .Signals plays a major role in our life, a signal can be a function of time, distance, position, temperature, etc., in an electrical system signals are electric current and voltage. In mechanical system signals may be force, speed, torque, etc. The signals that we encounter in daily life are speech, music, picture and video signals. In general, signals carry information.

A system may be defined as an integrated unit composed of diverse, interacting structures to perform a desired task. The task may be filtering of noise, detection of range of target in radar system. The function of system is to process a given input sequence to generate an output sequence.

III. PROBLEM IDENTIFICATION

Digital filters find applications in different areas. One area is power system protection where measurement systems involve faulted signals associated with DC decaying signals, harmonic and sub-harmonic components. To eliminate these unwanted components, digital filter design based on multi-objective optimization technique to satisfy different specifications such as high speed response for a real-time application and frequency domain requirements. A digital filter based solution is proposed to remove unwanted disturbances using digital filter design techniques. The filter time response must be included the requirements. The present filtering application imposes different kind of specifications. On one hand, the time domain requirement where both a high speed and accurate system response are needed. On the other hand, the frequency domain requirements which are the magnitude response within small bandwidth including sharp frequency edges as well as an approximately constant group delay in this band are required too. Usually the best optimum value of all the objective functions of this filter design can be obtained for some values of design

variables.

IV. MATLAB

MATLAB is being used as a platform for laboratory exercises and the problems classes in the Image Processing half of the Computer Graphics and Image Processing course unit. This handout describes the MATLAB development environment you will be using, you are expected to have read it and be familiar with it before attempting the Laboratory and Coursework Assignments. MATLAB is a data analysis and visualization tool designed to make matrix manipulation as simple as possible. In addition, it has powerful graphics capabilities and its own programming language. The basic MATLAB distribution can be expanded by adding a range of toolboxes, the one relevant to this course is the image- processing toolbox . The basic distribution and all of the currently available toolboxes are available in the labs. The basic distribution plus any installed toolboxes will provide a large selection of functions, invoked via a command line interface. MATLAB's basic data structure is the matrix1. In MATLAB a single variable is a 1 x 1 matrix, a string is a 1 x n matrix of chars. An image is a n x m matrix of pixels. MATLAB is started from within the Windows environment by clicking the icon that should be on the desktop.

V. CONCLUSION AND FUTURE SCOPE

Classical design methods of infinite impulse response are normally restricted to specific norms such as mini-max or least square. Additionally, the quantization effects of the coefficients are normally not possible to consider during the design process. To design filters with special requirements such as a trade-off in norms or concerning quantization effects there is a need of more general optimization techniques.FIR digital filters are widely used in the field of signal processing due to its distinguishing features such as: the stability, linear phase and easiness for realization. Traditionally, there exist some methods for FIR digital filters design, such as window method, frequency sampling method and best uniform approximation. Unfortunately, each of them is only suitable for a particular application. In recent years, many evolutionary computation techniques, such as simulated annealing approach, genetic algorithms, particle swarm optimization, have been employed to design FIR digital filter

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