

ECE 734 VLSI Array Structures for Signal Processing Final Project Proposal

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Title:

Fast Fourier Transform Algorithms and Implementations on General-purpose Computers

Objective:

Survey FFT algorithms and their design methodologies. Compare the performances for their implementations on general-purpose computers.

Introduction:

The discrete Fourier transform (DFT) is an important tool in many branches of science and engineering and has been studied extensively. For many practical applications, it is important to have an implementation of the DFT that is as fast as possible. In the past, speed was the direct consequence of clever algorithms that minimized the number of arithmetic operations. On present-day general-purpose microprocessors, however, the performance of a program is mostly determined by complicated interactions of the code with the processor pipeline, and by the structure of the memory. Hence, designing for performance under these conditions required an intimate knowledge of the computer architecture.

A successful example of this algorithm design methodology would be FFTW (Fast Fourier Transform in the West) developed at MIT that is competitive with or faster than proprietary codes such as Sun's Performance Library and IBM's ESSL library that are highly tuned for a single machine. Such encouraging results raise the hope that similar algorithm design methodology could be applied successfully to many other problems.

This project is intended to give a comprehensive review on the various currently available FFT algorithms and their implementations. Some of these algorithms have open source for reference, others will need to be implemented from scratch on general-purpose computers within this project. Emphasis will be given to the analysis of the algorithm designs where the underlying computer architectures have been taken into serious consideration. Finally, different implementations for one and multi-dimensional FFT algorithms will be compared.

Comments:

This is a survey and implementation type one-person project.