ABSTRACT

A New Fast Fourier Transform Algorithm

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In this thesis a novel algorithm is described and derived for the computation of the discrete Fourier transform (DFT) of a sequence of real or complex values whose length is a power of two. The new algorithm, called the Sine-Cosine Fourier Transform (SCFT), has the following characteristics, among others.

- Arithmetic complexity equivalent to other algorithms considered to be arithmetically optimum.
- Computed in place.
- No complex arithmetic for real or complex inputs.
- No data shuffling, or permutations, within the algorithm.
- Same algorithm (topology) for both real and complex input data.
- Real and imaginary outputs computed separately.
- Twiddle factors can be cosine only (or sine only) .
- Fewer twiddle factors than commonly used optimum radix-2 algorithms.

These features make the new algorithm a good candidate for further investigations aimed at optimizing software and hardware implementations. In addition it is

shown that the relationships derived in developing the SCFT can be used to define a second algorithm, SCFT II, with similar features. These relationships are also shown to enable the definition of a discrete cosine transform (DCT) algorithm.

Keywords: Iain Byam; FFT; DCT; Signal Processing.