An Extensible Systolic Convolver Array For Signal Processing in Time and Frequency Domains.

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ABSTRACT

The implementation of Digital Signal Processing (DSP) within modern Sonars has created a demand for higher levels of performance from semiconductor technology. This demand can now be serviced by processing devices developed largely for the commercial marketplace. This opportunity has arisen from the exponential growth in DSP application areas such as telecommunications, consumer audio and image processing. The systolic convolver array provides an efficient DSP architecture which can be used to satisfy a variety of algorithms including beamforming, convolution, and spectral estimation.

This paper describes the implementation of a systolic convolver array that has the form of a Vector Parallel Processor Unit (VPPU). This processing element can achieve 400 million multiply-accumulate (MAC) operations per second, and is extensible via transputer datalinks, so that flexible arrays can be constructed easily. The author shows how typical operations such as beamforming and spectral estimation can be mapped efficiently on to the VPPU. In particular, this paper describes how Number Theoretic Transforms (NTT) using circular convolutions can achieve conversion to the frequency domain within the VPPU.