

# Partitioned FFTC: An Improved Fast Fourier Transform For The IBM Cell Broadband Engine

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## Abstract

The Fast Fourier Transform is a widely used algorithm with numerous applications in scientific computing. Unfortunately, data dependencies can become a performance bottleneck in parallel FFT implementations. As multi-core and many-core architectures become common, it is particularly important to determine how the algorithm can be restructured to realize near-peak performance on these architectures.

In this paper, we explore a new approach to overcoming the FFT performance bottleneck on the Cell BE processor by decomposing a single FFT problem into multiple sub-problems that can be solved efficiently in parallel. We use

a divide-and-conquer partitioning scheme and an FFT kernel derived from David Bader's FFTC algorithm for the solution of the sub-problems. This approach achieves a 31% - 51% speedup versus FFTC without problem partitioning for problems with 1K-16K complex single-precision data points. Our code achieves a performance of 24.4 GigaFlops for a FFT on input of 8K complex samples using the 6 SPEs available on the Cell BE in a Sony PlayStation 3. We also report the performance of several other FFT packages on the Cell BE in our PlayStation 3, including VSIPL++, and show that our algorithm compares favorably with these packages.