Radix-2 Fast Fourier Transforms: Performance Analysis of Sequential and Different Parallel Approaches

A Fast Fourier Transform (FFT) is a widely used algorithm that samples a signal over a period of time and divides it into its frequency components, computing the Discrete Fourier Transform (DFT) of a sequence. Unlike the traditional approach to computing a DFT, FFT algorithms reduce the complexity of the problem from O(n2) to O(nLog n). This talk discusses the implementations of an FFT algorithm in C, OpenACC, and CUDA by comparing the pros and cons of such sequential and parallel implementations using a single CPU core or many GPU cores. The focus is on the easy-to-implement OpenACC approach and the manually-optimized CUDA approach, both of which are massively parallel. Additionally, matrix multiplication implementations are analyzed to further test the consistency of the OpenACC approach compared to CUDA.