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ECE 622

Jacobi Problem

Solution Overview

The Jacobi Simulation Problem can be parallelized by chunking the array and independently computing partial difference sums between the old state and new state. Once shared variables are initialized holding the total difference between the two states, each worker thread can compute partial differences amount their chunk and add them to the shared variable via a mutex.

Performance Results

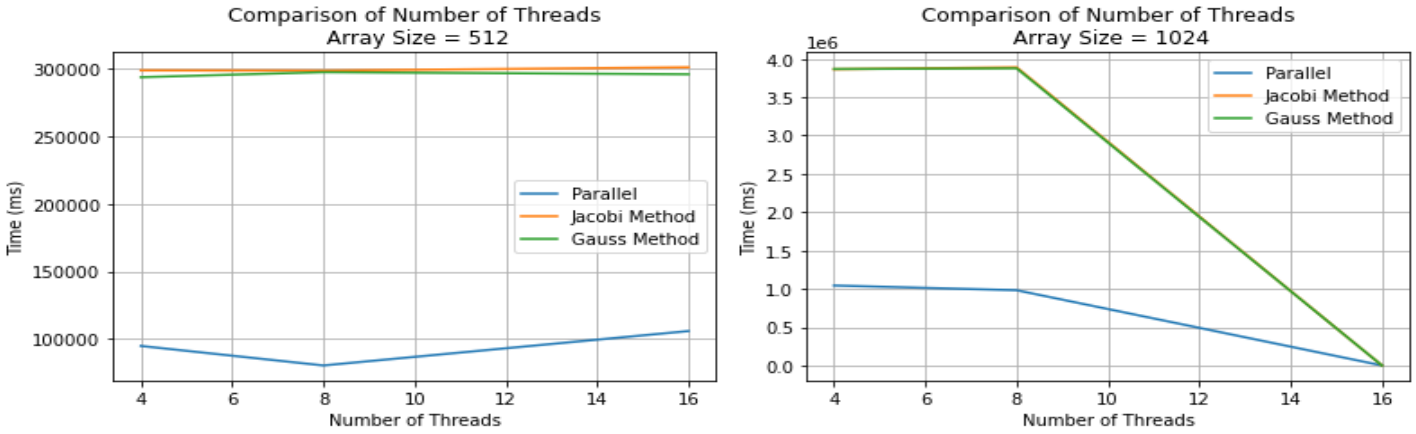

Figure 1: Plot of time vs number of threads and varying array size. The rest of the 1024 trials and 2048 trials were omitted due to computation restrictions on xunil.

Reflection

This problem saw significant speed up across all array sizes as most of the computational work is done during traversal and local computation in the array. All actions which are independent of each other which means that it is highly parallelizable. With that being said, the mutex and barrier synchronization points do hinder parallel performance but that is mitigated by giving each thread similar workloads thus minimizing the amount of time hung at barrier synchronization points. The critical section is a relatively small hindrance since most of the computation time is spent in the unblocked array.