Parallelize Jacobi Relaxation Using MPI

# Experimentation data for Serial computation

|  |  |  |  |
| --- | --- | --- | --- |
| **Serial Computation results with P\* = 1 and Imax = 100** | | | |
| **(N,R,C)** | **Runtime (seconds)** | **Iteration** | **Tolerance** |
| (2304,2302,2300) |  | 100 |  |
| (4320,4318,4316) |  | 100 |  |
| (10080,10078,10076) |  | 100 |  |

\*: P denotes the number of processes.

# Row Decomposition

## Overview of the Implementation

While implementing, we assumed that the grid length N is evenly divisible by the number of processors P.

Each process is responsible for the boundary value updation and grip computation of N/P number of contiguous rows. During the communication phase, processes exchange their boundary rows to the neighboring processes ( for example, a process with rank r will send its bottom-most row and topmost row to process with rank r+1 and r-1 respectively and receive the topmost row from process r+1 and bottom-most row from rank r-1. Obviously for process with rank 0 and P-1, there will be only one send and receive because they have only one neighbor instead of two.

## Experimentation data for Serial computation

### Tabular Representation

N = Grid length

(R,C) = A single floating-point value for the temperature at cell (R,C)

Tolerance = The value of *gmaxdiff* in the code, which gives the maximum change for any point below the threshold value,

Iteration = The maximum number of iterations reached.

|  |  |  |  |
| --- | --- | --- | --- |
| **Row Decomposition with P =12 and Imax = 100** | | | |
| **(N,R,C)** | **Runtime (seconds)** | **Iteration** | **Tolerance** |
| (2304,2302,2300) |  | 100 |  |
| (4320,4318,4316) |  | 100 |  |
| (10080,10078,10076) |  | 100 |  |
| **Row Decomposition with P = 24 and Imax = 100** | | | |
| (2304,2302,2300) |  | 100 |  |
| (4320,4318,4316) |  | 100 |  |
| (10080,10078,10076) |  | 100 |  |
| **Row Decomposition with P = 36 and Imax = 100** | | | |
| (2304,2302,2300) |  | 100 |  |
| (4320,4318,4316) |  | 100 |  |
| (10080,10078,10076) |  | 100 |  |
| **Row Decomposition with P = 48 and Imax = 100** | | | |
| (2304,2302,2300) |  | 100 |  |
| (4320,4318,4316) |  | 100 |  |
| (10080,10078,10076) |  | 100 |  |

### Graphical Representation

### 