ECE 4122/6122 Lab 2: Using OpenMP to Calculate the Electric Field Produced by Array of Point Charges

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Objective:

To understand and apply the principles of OpenMP for parallel calculations in a computationally-intensive problem related to the Electric Field calculations.
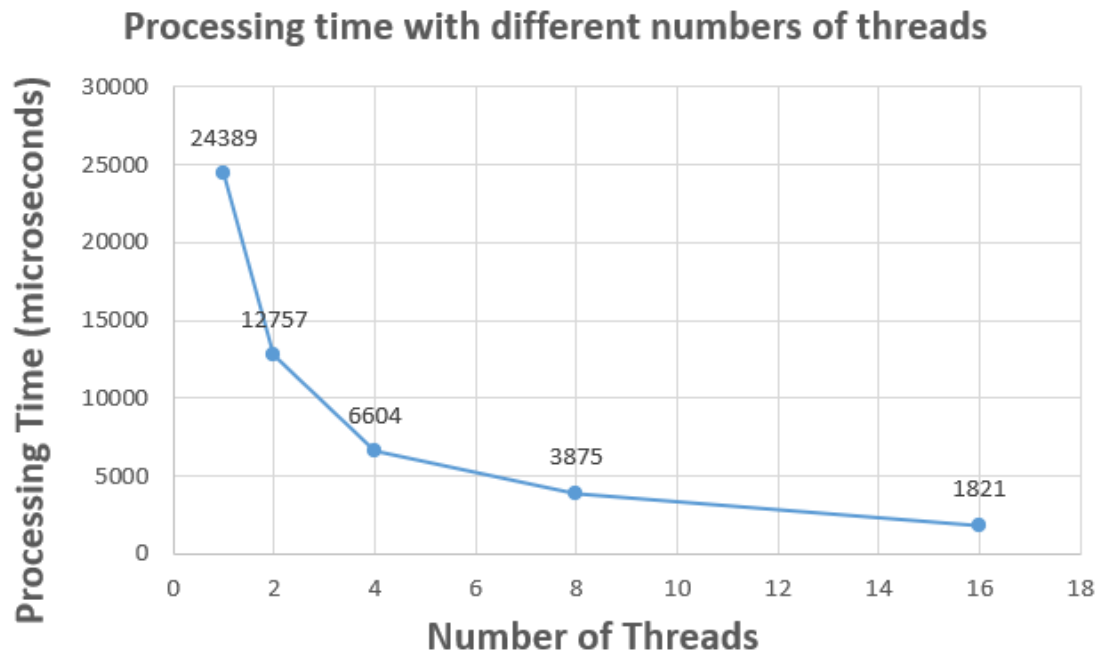
Results:

Figure1

As shown in Figure 1, as the number of threads increases, the processing time decreases, reducing the time to 1/2 of the original each time.

Screenshots:

```
[zzhang3180@atl1-1-01-005-4-2 Lab2]$ g++ *.cpp -fopenmp
[zzhang3180@atl1-1-01-005-4-2 Lab2]$ ./a.out
Please enter the number of concurrent threads to use: 1
Please enter the number of rows and columns in the N x M array: 1000 1000
Please enter the x and y separation distances in meters: 0.01 0.03
Please enter the common charge on the points in micro C: 0.02
Please enter the location in space to determine the electric field (x y z) in meters: 1 2 3
The electric field at (1, 2, 3) in V / m is
Ex = 3.2774 * 10^5
Ey = 9.6402 * 10^4
Ez = 2.3622 * 10^6
|E| = 2.3868 * 10^6
The calculation took 24389 microsec!

[zzhang3180@atl1-1-01-005-4-2 Lab2]$ ./a.out
Please enter the number of concurrent threads to use: 2
Please enter the number of rows and columns in the N x M array: 1000 1000
Please enter the x and y separation distances in meters: 0.01 0.03
Please enter the common charge on the points in micro C: 0.02
Please enter the location in space to determine the electric field (x y z) in meters: 1 2 3
The electric field at (1, 2, 3) in V / m is
Ex = 3.2774 * 10^5
Ey = 9.6402 * 10^4
Ez = 2.3622 * 10^6
|E| = 2.3868 * 10^6
The calculation took 12757 microsec!
```

```
[zzhang3180@atl1-1-01-005-4-2 Lab2]$ ./a.out
Please enter the number of concurrent threads to use: 4
Please enter the number of rows and columns in the N x M array: 1000 1000
Please enter the x and y separation distances in meters: 0.01 0.03
Please enter the common charge on the points in micro C: 0.02
Please enter the location in space to determine the electric field (x y z) in meters: 1 2 3
The electric field at (1, 2, 3) in V / m is
Ex = 3.2774 * 10^5
Ey = 9.6402 * 10^4
Ez = 2.3622 * 10^6
|E| = 2.3868 * 10^6
The calculation took 6604 microsec!

[zzhang3180@atl1-1-01-005-4-2 Lab2]$ ./a.out
Please enter the number of concurrent threads to use: 8
Please enter the number of rows and columns in the N x M array: 1000 1000
Please enter the x and y separation distances in meters: 0.01 0.03
Please enter the common charge on the points in micro C: 0.02
Please enter the location in space to determine the electric field (x y z) in meters: 1 2 3
The electric field at (1, 2, 3) in V / m is
Ex = 3.2774 * 10^5
Ey = 9.6402 * 10^4
Ez = 2.3622 * 10^6
|E| = 2.3868 * 10^6
The calculation took 3875 microsec!

[zzhang3180@atl1-1-01-005-4-2 Lab2]$ ./a.out
Please enter the number of concurrent threads to use: 16
Please enter the number of rows and columns in the N x M array: 1000 1000
Please enter the x and y separation distances in meters: 0.01 0.03
Please enter the common charge on the points in micro C: 0.02
Please enter the location in space to determine the electric field (x y z) in meters: 1 2 3
The electric field at (1, 2, 3) in V / m is
Ex = 3.2774 * 10^5
Ey = 9.6402 * 10^4
Ez = 2.3622 * 10^6
|E| = 2.3868 * 10^6
The calculation took 1821 microsec!
```