

ME759
High Performance Computing for Engineering Applications
Assignment 10
Date Assigned: November 19, 2013
Date Due: November 25, 2013 – 11:59 PM

The goal of this assignment is as follows:

- Getting familiar with OpenMP

Problem 1. Write a program that relies on OpenMP-enabled parallel programming to evaluate the integral

$$I = \int_0^{100} e^{\sin x} \cos\left(\frac{x}{40}\right) dx$$

Note that the value provided by MATLAB for this integral is $I = 32.121040688226245$. To approximate the value of I use the following extended Simpson's rule:

$$\int_0^{100} f(x) dx \approx \frac{h}{48} \left[17f(x_0) + 59f(x_1) + 43f(x_2) + 49f(x_3) + 48 \sum_{i=4}^{n-4} f(x_i) + 49f(x_{n-3}) + 43f(x_{n-2}) + 59f(x_{n-1}) + 17f(x_n) \right]$$

In the approximation above,

$$x_0 = 0, \quad x_n = 100, \quad h = 10^{-4}, \quad \text{and} \quad n = \frac{100 - 0}{h} = 10^6.$$

This value of n goes to say that you divide the interval $[0, 100]$ in 106 subintervals when evaluating I .

After implementing the code, you will have to run the code on Euler using

- One computational thread (sequential execution)
- Using OpenMP on either an Intel (up to 8 physical and 16 virtual cores) or AMD (up to 64 cores) per box. Try to squeeze as much performance as possible out of the available hardware.

Answer:

For AMD (upto 64 cores) on Euler26

Optimization flags	Serial timing	Parallel timing	Speed up
-o2 -ofast	157.307705 ms	6.7936 ms	23.16 times (approx..)

For Intel (upto 16 cores) on Euler01

Optimization flags	Serial timing	Parallel timing	Speed up
-o2 -ofast	130.115226 ms	11.926627 ms	10.9 times (approx..)

This shows that AMD processor perform faster in case of parallel timing but in Intel perform faster in case of serial timing.