

**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,  $x_0 = 0$ ,  $x_n = 100$ ,  $h = 10^{-4}$ , and  $n = \frac{100 - 0}{h} = 10^6$ . This value of  $n$  goes to say that you divide the interval  $[0, 100]$  in  $10^6$  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

Please report your timing results on the forum for both the sequential and OpenMP solutions. Report times in milliseconds.

- Your source code ready to be compiled and run by the TA
- A report that includes a summary of the timing results
- Please work on the assignment individually