Tutorial - 10

In this tutorial, you will develop and test derivative calculation using MPI. Further, you will explore several MPI functions that are not discussed in the lectures.

1. Consider the following equation.

$$u(x) = x\tan(x), \tag{1}$$

and $x = [-1, 1]$. Write an MPI program to compute the first derivative of $u(x)$ that is $du(x)/dx$ over the range of x given using first, and second-order accurate central difference formulas that were discussed in the lecture. You can use first-order accurate formulas on the boundary and near-boundary points. Use grid sizes of $\Delta x = 0.01$ and 0.001. Test your code using $p = 2, 4$ and 8 processors. Compare the results you obtain using the analytical solution and make sure the numerical solution obtained using your parallel program are correct.

2. Learn about other MPI functions such as MPI_Gatherv, MPI_Scatterv, MPI_Dims_create, MPI_Cart_create, MPI_Cart_rank, MPI_Cart_coords. Ponder where they may be useful.