Today:
- MPI in subroutines
- Comments on Homework 6
- Python plotting

Friday:
- Grady on GPUs

Read: Class notes and references
New MPI examples.
Send me your info if you want totalview
Make sure Python plotting works

MPI with subroutines and functions

Recall Simpson’s rule program from Homework 5:

In OpenMP: Subroutine is called by the single master thread running the main program.
Inside the subroutine a singleomp parallel block is used to for a set of threads that are used for the full computation.
End of a parallel block kills all threads except master thread.

In MPI: First statement in main program must beMPI_INIT.
It's not possible to callMPI_INITin the subroutine.
The entire code (including main program and call to subroutine) is executed by each process (maybe on different computers!).
Call toMPI_FINALIZEkills all processes.

Python plotting

In $CLASSHG/codes/mpi/heat1d:

$CLASSHG/codes/mpi/heat1d

$ make plots
Executes $CLASSHG/codes/python/plotheat1d.py and produces plot.png.

In $CLASSHG/codes/fortran/heat2d:

$CLASSHG/codes/fortran/heat2d

$ make plots
Executes $CLASSHG/codes/python/plotheat2d.py and produces pcolor.png and contour.png.

In Homework 6, use this same plotter $CLASSHG/codes/python/plotheat2d.py.
Python plotting

Can also plot interactively:

```bash
$ cd $CLASSHG/codes/fortran/heat2d
$ make heatsoln.txt  # runs code
$ ipython -pylab
In[1]: run ../../python/plotheat2d.py
In[2]: show()
In[3]: Quit
```

Using matplotlib

```
$ ipython -pylab
starts ipython in manner that interactive plots work.
This also automatically does...

from pylab import *

which puts all NumPy and matplotlib plotting routines in
namespace, so e.g.:

In [1]: x = linspace(0, 1, 101)
In [2]: plot(x, x**2, 'r-o')

To make it clear where things come from:

In [1]: import numpy as np
In [2]: from matplotlib import pyplot as plt
In [3]: x = np.linspace(0, 1, 101)
In [4]: plt.plot(x, x**2, 'r-o')
```

Python plotting with matplotlib

Best way to learn is to browse the gallery:

http://matplotlib.sourceforge.net/gallery.html

See the class notes for some tips and other pointers:

Python plotting section