

## Set 06 - Advanced MPI and TORC

Issued: April 9, 2018

Hand in: April 16, 2018

### Question 1: MPI Diffusion

We are revisiting the heat diffusion problem. This time we will parallelize the 2D diffusion equation with MPI, using advanced MPI features.

- a) Parallelize the serial 2D diffusion code found in `q2/diffusion2d_serial.cpp` with MPI. Divide the 2D domain with an MPI cartesian grid and use appropriate MPI datatypes for the data transfer.
- b) Make a strong scaling plot up to 48 cores.

### Question 2: Parallel Numerical Integration using TORC

The goal of this question to help you become familiar with the TORC tasking library. Install and then use the TORC library to parallelize the Monte Carlo and Adaptive integrators introduced in Exercise 3.

You can download `torc_lite_hpcse.tar.gz` from here: [http://www.cse-lab.ethz.ch/wp-content/uploads/2018/04/torc\\_lite\\_hpcse.tar.gz](http://www.cse-lab.ethz.ch/wp-content/uploads/2018/04/torc_lite_hpcse.tar.gz)

Installation instructions on Euler:

- `module load gcc; module load mvapich2`
- `cd torc_lite_hpcse; ./configure --prefix=$HOME/usr/torc CC=mpicc F77=mpif90`
- `make; make install`
- `export PATH=$PATH:$HOME/usr/torc/bin` (you can add this to your `.bash_profile`)

How to run the basic demo program:

- `cd torc_lite_hpcse/demo`
- `mpirun -n 1 ./masterslave` (one rank)
- `mpirun -n 2 ./masterslave` (two ranks)
- `mpirun -n 1 -env TORC_WORKERS 2 ./masterslave` (one rank, two threads)
- `mpirun -n 2 -env TORC_WORKERS 2 ./masterslave` (two ranks, two threads)

How to compile an application:

- `export PATH=$PATH:$HOME/usr/torc/bin` (you can add this to your `.bash_profile`)
- `mpicc 'torc_cflags' -o mycode mycode.c 'torc_libs'`
- `mpirun -n 2 ./mycode`