Parallel Computing

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1. Course Description
In recent decades, the development of computer technology has been remarkable, and accordingly, the request for executing large-scale numerical simulations has increased. In order to decrease the calculation time, parallel computing is employed. There are roughly two types of parallel computing: shared memory parallel and distributed memory parallel. You will study the concepts and features of each method, and how to program and execute parallel computing using MPI or OpenMP. In addition, performance of parallel computation of simple fluid analysis will be performed using open source thermal-fluid analysis software, and performance will be evaluated.
You will acquire knowledge and skills on DP1 and DP3 of diploma policies.

2. Course Objectives
The goal is to understand the concepts and techniques of distributed computing. So that you will become able to create parallelized programs using MPI or OpenMP for simple problems, and execute parallel computation on a computer.

3. Grading Policy
Your grade will be assessed based on the scores of reports of exercise problems (80%) and final exams (20%). It should be noted that four exercise problems will be given.
LMS posts class materials, receives reports, and provides feedback.

4. Textbook and Reference
Reference
It is recommending that you collect information using library materials and internet.
片桐孝洋　スパコンプログラミング入門: 並列処理とMPIの学習　東京大学出版会、ISBN-13: 978-4130624534
片桐孝洋　　　並列プログラミング入門: サンプルプログラムで学ぶOpenMPとOpenACC　東京大学出版会、ISBN-13:978-4130624565

5. Requirements(Assignments)
For the preparation, you should study in advance for each class based on reference books, library materials, and materials collected via the Internet. (2 hours)
After the class, you should review and work on exercise problems for report in order to improve your understanding. (1 hour)

6. Note
Open source compiler and thermal-fluid analysis software will be installed on your computer and calculations will be executed.

7. Schedule
[1]   Proceeding of classes, history of computers, overview of parallel computing
[2]   C compiler setup and programming basics
[3]   Fortran compiler setup and programming basics
[4]   Overview of shared memory parallel and distributed memory parallel, and parallel computing
[5]   OpenMP for Shared Memory Parallel Processing (1): Overview
[6]   OpenMP for Shared Memory Parallel Processing (2): Programming for parallelization
[7]   OpenMP for Shared Memory Parallel Processing (3): Execute of Parallel computing
[8]   OpenMP for Shared Memory Parallel Processing (4): Performance evaluation
[9]   MPI for Distributed Memory Parallel Processing (1): Overview
[10]   MPI for Distributed Memory Parallel Processing (2): Programming for parallelization
[11]   MPI for Distributed Memory Parallel Processing (3): Execute of Parallel computing
[12]   MPI for Distributed Memory Parallel Processing (4): Performance evaluation
[13]   Fire Dynamics Simulator (FDS) (1): Overview and setup
[14]   Fire Dynamics Simulator (FDS) (2): Creating an input file
[15]   Fire Dynamics Simulator (FDS) (3): Performance evaluation of parallelization using thermal-fluid analysis