2013 Graduate General Education
「High Performance Parallel Computing Technology for Computational Scie
(01ZZ607)

Lecture Day : **January 21-22, 2014**
Location : International Workshop Room, Center for Computational Science

Course Overview

High performance computing is the basic technology to support today's
hardware and software for high-end computing such as high speed com
high speed numerical algorithm, programming scheme and system soft
based on large scale parallel processing systems and it is required even
effective utilization of them. In this class, we focus on the basic technol
performance tuning for application users who aim to use these systems

Schedule

Jan. 21 (Tue)

9:00-10:30	Fundamentals on HPC and Parallel Processing
10:45-12:15	Parallel Processing Systems
13:30-15:00	Parallel Programming 1: OpenMP
15:15-16:45	Parallel Programming 2: MPI

Jan. 22 (Wed)

9:00-10:30	Parallel Numerical Algorithm 1
10:45-12:15	Parallel Numerical Algorithm 2
13:30-15:00	Optimization 1: Computation Optimization
15:15-16:45	Optimization 2: Communication Optimization
	Usage of T2K

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1	Fundamentals on HPC and Parallel Processing
2	Parallel Processing Systems
3	Parallel Programming 1 - OpenMP
4	Parallel Programming 2: MPI
5	Parallel Numerical Algorithm 1
6	Parallel Numerical Algorithm 2

7	Optimization 1 - Computation Optimization
8	Optimization 2: Communication Optimization
	Usage of T2K

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large scale scientific simulations. It covers widely spread issues on
ıputation, high speed networking, large scale memory and disk storage,
ware to support them. Current advanced supercomputer systems are
for application users to understand a certain level of these informations for
ɔgy of high-end computing systems, programming, algorithm and
for their practical simulation and computing.

Contents	Lecturer
Amdahl's law, Parallelization methods (EP, Data parallelism, Pipeline parallelism), Communication, Synchronization, Parallelization efficiency, Load balance.	Taisuke Boku
Parallel processing systems (SMP, NUMA, Cluster, Grid, etc.), Memory hierarchy, Memory bandwidth, Network, Communication bandwidth, Delay.	Yuetsu Kodama
Parallel programming model, parallel programming language OpenMP.	Mitsumisa Sato
Parallel programming language MPI2.	Claus Aranha
Krylov subspace iterative methods and their parallelization methods.	Hiroto Tadano
Fast Fourier Transformation (FFT) and its parallelization methods.	Daisuke Takahashi

Program optimization techniques (Register blocking, Cache blocking, Memory allocation, etc.) and performance evaluation on a compute node of parallel processing systems.	Claus Aranha
Optimization techniques and performance evaluation of parallel programming on parallel processing systems.	Osamu Tatebe
Usage of T2K Open SuperComputer, NUMA, and MultiRail network.	