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MS53
Teaching Concurrency

Many parallel algorithms employ restricted forms of concurrency such as barrier synchronization or message-passing on a regular grid. Yet programmers need to understand general problems of process coordination and communication to maximize parallelism, avoid subtle timing problems, and control costs. This talk describes 25 years of teaching concurrency, and the tradeoffs between focusing on implementation details of synchronization primitives for multitasking and on higher-level issues of their use.

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MS53
Parallel Scientific Computing: Remembrances and Reflections on Supercomputing

Reflections on a career in research and teaching scientific supercomputing. Remembrance of modifying code and adapting algorithms for use on supercomputers as they evolved from serial to vector to parallel to parallel-vector to clusters. As well as, comments on teaching scientific parallel computing to undergraduate students.

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MS54
Petaflop Challenges in Lattice QCD

Lattice QCD is arguably the only feasible approach to evaluate quantum chromodynamics (QCD), the theory which explains the quarks as the constituents of matter. Lattice QCD requires very heavy computer simulations which can take up to several months on current parallel supercomputers. In this talk we will motivate how this enormous demand for computing powers arises and why these computations are suitable for highly parallel computers. We will also address recent progress in modelling and algorithmic development.

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MS54
Towards Petascale Adaptive Simulations of Mantle Convection

Mantle convection is the principal control on the thermal and geological evolution of the Earth. It is central to our understanding of the origin and evolution of tectonic deformation, the evolution of the thermal and compositional states of the mantle, and ultimately the evolution of the Earth as a whole. Mantle convection is an important driver for petascale computing, due to the wide range of length and time scales involved. Our goal is to conduct high resolution mantle convection simulations that can resolve thermal boundary layers and faulted plate boundaries, down to 1 km scales. To enable this (local) resolution, we are developing `Rhea`, a new generation mantle convection code incorporating parallel adaptive mesh refinement/coarsening algorithms designed to scale to hundreds of thousands of processors. We discuss parallel performance on *Ranger*, the new 500 Teraflops system at TACC.

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MS54
High Performance Computing Strategies for Adaptive FEM Simulations

We propose the relocation of grid points preserving the topological structure of the mesh ("grid deformation") as technique for grid adaptation in FEM. Our approach allows for maintaining locally structured grids during the adaptation process in contrast to the widespread elementwise h-adaptivity and requires little additional numerical effort only. We discuss the derivation and realisation of our method, its asymptotic complexity and its accuracy. We show applications to examples in CFD and CSM.

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MS55
Supporting Visual Data-mining by Dimension Reduction

To support visualization of high dementional data, we introduce algorithm "HyperMap" for mapping data to 3-dimensional space, and develop a novel parametric visu-

alization. HyperMap holds the linear computation complexity, but releases the restriction that each dimension has only two pivot objects. Having more than 2 pivots to represent one dimension enables less information-loss. Tunning the weights of pivots, the scatter of data can be observed in various viewpoints, the impacts of bad pivot object is reduced, too.

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MS55

InfoSpace Governance Technologies for People Working Together

Information spaces created by cooperative knowledge workers are difficult to manage, because such an information space spreads over distributed and heterogeneous systems and data integrity and circulation is not supported in systematic ways. We approach to the problem by developing technologies to manage metadata on the information spaces to control the status and circulation of information in the spaces. This talk addresses the technological issues and their roles in the visual data-mining project.

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MS55

VINDAM: Data Visualization and Data Mining in Tele-immersion Environment

In this study, the tele-immersion environment was constructed by connecting several CAVE-like immersive projection displays through the broad-band network. In this environment, remote users can communicate with each other using the video avatar in the shared virtual world. In addition, they can retrieve the necessary data from the database through the network and handle them synchronously. This environment was applied to the collaborative data visualization and the visual data mining in the immersive virtual world.

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MS55

Gfarm Grid File System for Visual Distributed Data-Mining

Gfarm Grid file system has been developed for facilitating reliable file sharing and high-performance data computing in a Grid across administrative domains. It is a scalable virtual file system federating local file systems of cluster nodes. This talk describes the design and implementation of a secure, robust, scalable and high-performance Gfarm file system.

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PP0

A Parallel Algorithm for Elliptic Eigenvalue Problems on Polygonal Domains Using Spectral Method

Here we show a technique to solve the elliptic eigenvalue problems on polygonal domains using *h-p* spectral element method on parallel computers. We develop a MPI-based parallelization algorithm, to seek a solution which minimizes a weighted squared norm of the residuals in PDEs and a norm of the residuals in the boundary conditions and enforce continuity by adding a term which measures the jump in the function and its derivatives at inter element boundaries to the functional being minimized.

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