DCSE Summerschool June 5-9, 2023: Numerical Linear Algebra on High Performance Computers

Location lectures and labs: Penguin lab, Building 36, HB 02.130, TU Delft

Location symposium: Aula TU Delft, Commissiekamer 3

Registration: https://www.aanmelder.nl/143287

Contact: j.thies@tudelft.nl

Time	Monday	Tuesday	Wednesday	Thursday	Friday
9:15-10:00	Lecture PB1	Lecture PB2	Lecture GW1	Lecture GW2	Lecture LG2
10:00-10:15	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10:15-11:00	PB1 cont'd	PB2 cont'd	GW1 cont'd	GW2 cont'd	LG2 cont'd
11:00-12:00	Lab 1	Lecture JT	Lab 3	Lecture LG1	Lecture MM
12:00-13:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00-14:00	Lab 1 cont'd	Lecture MG		LG1 cont'd	QC Lab
14:00-14:15	Coffee break	Coffee break	HPC Symposium	Coffee break	Closing
14:15-15:00	Lecture KL	Lecture AH	Talks, Posters,	Lab 4	
15:00-17:00	GPU Lab	Lab 2	Drinks & Snacks		

Special Events

Tuesday: Dinner with Dinner Talk by Gerhard Wellein

Wednesday: Symposium for broader audience, poster session with drinks and snacks

Lecturers:

PB: Prof. Paolo Bientinesi, Umeå

GW: Prof. Gerhard Wellein, University of Erlangen-Nuremberg

LG: Prof. Laura Grigori, EPFL Lausanne

Local lecturers: MG: Prof. Martin van Gijzen, KL: Kees Lemmens, JT: Jonas Thies, AH Alexander Heinlein, MM: Matthias Möller

Lectures:

PB1: Blocked algorithms vs. algorithms by blocks. (Ex.: Cholesky) Data dependencies, task queues, out of order execution.

PB2: Mapping a matrix expressions to linear algebra kernels, Use case: Genome-Wise Association Studies (GWAS).

GW1: parse matrix formats, SpMV and performance models

GW2: cache blocking for communication-avoiding sparse linear solvers

LG1: communication-avoiding in linear algebra algorithms, bounds on communication and how to achieve them

LG2: Randomization in linear algebra applications

KL: GPUs for linear algebra, hardware characteristics and programming techniques

MG: Communication-avoiding Krylov methods

JT: HPC software design patterns in Trilinos (Kokkos, Petra, Belos)

AH: Advanced Domain Decompositionh preconditioniers

MM: Introduction to Quantum Annealing

Lab sessions:

Monday

- task-based dense LU factorization (OpenMP)
- Dense Matrix-Vector, multiplication on GPUs: OpenMP offloading, CUDA and (Cu)BLAS

Tuesday

- Sparse linear solvers on CPU and GPU using Trilinos
- Domain Decomposition method FROSch in Trilinos

Wednesday

- Performance analysis of Sparse Matrix-Vector (SpMV) products using Likwid

Thursday

- Communication-avoiding Krylov methods: polynomial preconditioners and s-step methods

Friday

- First steps on a Quantum Annealer