
Iterative Linear Solvers and Parallelization @ HLRS

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Iterative Linear Solvers & Parallelization @HLRS – 1st day

Content

MPI on beginners' level



[Tobias Haas and Rolf Rabenseifner]

1. MPI Overview
2. Process model and language bindings
3. Messages and point-to-point communication
4. Nonblocking communication

File: [mpi 3.1 rab.pdf](#)

Schedule

08:45 Login to ZOOM (hybrid course only)
(and establishing the break-out rooms)

09:00 Welcome

09:05 Lectures and exercises on MPI
(including some breaks)

12:30 Lunch break

13:45 Lectures and exercises on MPI
(including some breaks)

16:45 End

After the course:

S-Bahn to the city (self-paying)

City sightseeing walking tour (free)

Dinner (self-paying)

Iterative Linear Solvers & Parallelization @HLRS – 2nd day


Content

Shared memory parallelization with OpenMP [Lucienne Dettki and Rolf Rabenseifner]

Overview 

Execution model 

Worksharing directives 

Worksharing – continued (Exe 2b) 

Data environment 

Heat example (homework) 

Summary 

Pitfalls 

Q&A

Schedule

08:45 Login to ZOOM (hybrid course only)

09:00 Lectures and exercises on OpenMP
(including some breaks)

12:30 **Lunch break**

13:45 Lectures and exercises on OpenMP
(including some breaks)

16:45 **Final end**

File: [openmp-intro13.pdf](#)

Iterative Linear Solvers & Parallelization @HLRS – 3rd day

Content

Iterative Solvers for Large Linear Systems

[Andreas Meister]

Files: in **Lectures_Original_Version** (with animation)
and **Lectures_Print_Version** (without animation)
and [exercises_matlab.pdf](#)

9:00 Introduction, Basics and Practicals (Lecture I. + Practicals)

10:00 Consistency and Convergence (Lecture I. continued)

11:00 **Break**

11:30 Jacobi Method (Lecture II.)

12:15 Practicals

13:00 **Lunch**

14:15 Gauß-Seidel Method (Lecture II. continued)

14:45 Practicals

15:15 Q+A

15:30 **Break**

15:45 **MPI:**

6-(1) Collective Communication



File: [mpi_3.1_rab.pdf](#)

16:45 **End**

Schedule

08:45 Login to ZOOM (hybrid course only)

09:00 Lectures & exercises on Iterative Solvers
(including some breaks)

13:00 Lunch break [30 Minutes later!]

14:15 Lectures & exercises on Iterative Solvers
(including some breaks)


15:30 **Other options on MPI**

16:45 Final end

Iterative Linear Solvers & Parallelization @HLRS – 4th day

Content

Iterative Solvers for Large Linear Systems [Andreas Meister]

- 9:00 Relaxation Schemes (Lecture II. continued)
- 10:00 Practicals
- 10:45 Break
- 11:00 Method of Steepest Descent (Lecture III.)
- 11:30 Practicals
- 12:00 Lunch
- 13:15 Method of Conjugate Gradients (Lecture III.)
- 14:15 Practicals
- 15:00 Q+A
- 15:15 Break
- 15:30 **MPI & OpenMP:**
Parallelization of Explicit and Implicit Solvers (talk) 
File: [parallelization_rab.pdf](#)
- 16:45 End

Schedule

- 08:45 Login to ZOOM (hybrid course only)
- 09:00 Lectures & exercises on Iterative Solvers
(including some breaks)
- 12:00 Lunch break [30 Minutes earlier!]
- 13:15 Lectures & exercises on Iterative Solvers
(including some breaks)
- 15:30 For MPI & OpenMP: Parallelization
- 16:45 Final end

Iterative Linear Solvers & Parallelization @HLRS – 5th day

Content

Iterative Solvers for Large Linear Systems

[Andreas Meister]

09:00 Introduction to Multigrid Methods (Lecture IV.)

10:00 Practicals

10:30 Break

10:45 GMRES and BICG (Lecture V.)

11:45 Practicals

12:15 Lunch

13:30 Variants of BICG (Lecture V. continued)

14:00 Practicals

14:30 Preconditioning (Lecture VI.)

15:30 Q+A

15:45 Break

16:00 **MPI:** 12. Derived datatypes (talk w/o practical)

(1) transfer any combination of typed data

File: [mpi 3.1 rab.pdf](#)



16:30 Q+A / Feedback

16:45 End

Schedule

08:45 Login to ZOOM (hybrid course only)

09:00 Lectures & exercises on Iterative Solvers (including some breaks)

12:15 Lunch break [15 Minutes earlier!]

13:30 Lectures & exercises on Iterative Solvers (including some breaks)

16:00 Other options on MPI

16:30 Feedback

16:45 Final end