

# Node-Level Performance Engineering

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<http://goo.gl/WRc01H>





- **28 teaching hours:**
  - 14 hours of lecture
  - 14 hours of programming exercises

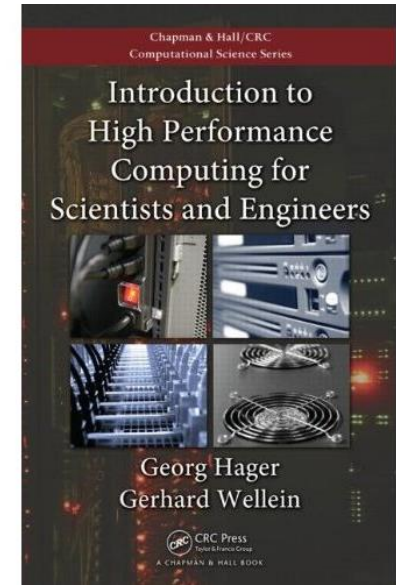
	Monday	Tuesday	Wednesday	Thursday	Friday
8:30	NLPE	NLPE	NLPE		NLPE
10:30				NLPE	
13:30	NLPE	NLPE		NLPE	NLPE
15:30					
17:30					

- **3 ECTS certificate – oral exam: May/June?**
- **Programming exercises will be done at Emmy cluster of Erlangen Regional Computing Center**



## Books:

- G. Hager and G. Wellein:  
*Introduction to High Performance Computing for Scientists and Engineers.*  
CRC Computational Science Series, 2010.  
ISBN 978-1439811924
- J. Hennessy and D. Patterson:  
*Computer Architecture. A Quantitative Approach.*  
Morgan Kaufmann Publishers, Elsevier, 2003. ISBN 1-55860-724-2
- W. Schönauer: *Scientific Supercomputing.* (2000)  
(cf. <http://www.rz.uni-karlsruhe.de/~rx03/book/>)



- **Check out Georg's blog for many interesting topics on performance engineering:**

<http://blogs.fau.de/hager/>



- **Node-level Computer architecture – revisited**
  - Basics
  - Single core architecture
  - Memory hierarchy
  - Shared Memory nodes: UMA vs. ccNUMA
  - Microbenchmarking
  - Case Study: Vector sum
  
- **Roofline Model**
  - The model
  - Case studies
    - Dense matrix-vector multiplication
    - Stencil kernels
    - Sparse matrix-vector multiplication
  
- **The costs of parallelization**

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- **ECM model**
  - The model
  - Understanding memory access performance
  - Dense Matrix Vector Multiplication
  - Stencils
- SIMD in depth
- ccNUMA in depth

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