High-Performance Computing on Multi- and Manycore Processors

<table>
<thead>
<tr>
<th>Module-No./Abbreviation</th>
<th>Credits</th>
<th>Workload</th>
<th>Term</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE-WP25/HPCM</td>
<td>6 CP</td>
<td>180 h</td>
<td>2nd Sem.</td>
<td>Summer term</td>
<td>1 Semester</td>
</tr>
</tbody>
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**Courses**

High-Performance Computing on Multi- and Manycore Processors

**Contact hours**

4 SWS (60 h)

**Self-Study**

120 h

**Group Size:**

No Restrictions

**Prerequisites**

- 

**Learning goals / Competences**

After successfully completing the module, the students

- are enabled to design and create programs for multi- and manycore processors,
- can critically evaluate multi-threaded programs and shared-memory access patterns,
- are able to survey advanced scientific topics independently and present their findings.

**Content**

The lecture addresses parallelization for multi- and manycore processors. Thread-based programming concepts (pthreads, C++11 threads, OpenMP, OpenCL) are introduced and best-practice implementation aspects are highlighted based on applications from scientific computing.

In the first part, the lecture provides an overview on relevant data structures, solver techniques and programming patterns from scientific computing. An introduction to multi-threading programming on multicore systems is then provided with special attention to shared-memory aspects. Parallelization patterns are discussed and highlighted. Numerical experiments and self-developed software implementations are used to discuss and illustrate the presented content.

In the second part, students are assigned advanced topics for shared-memory computation from the engineering science including finite element methods and artificial intelligence. Based on a scientific paper, students present their topic to the lecture audience in form of a beamer presentation and numerical illustrations.

**Teaching methods / Language**

Lecture (2h / week), Exercises (2h / week) / English

**Mode of assessment**

Homework (100%, Presentation)

**Requirement for the award of credit points**

Successful homework including presentation, Q&A session after presentation

**Module applicability**

MSc. Computational Engineering, MSc. Bauingenieurwesen, MSc. Angewandte Informatik

**Weight of the mark for the final score**

6 %

**Module coordinator and lecturer(s)**

Prof. Dr. A. Vogel, Assistants

**Further information**