

**Module title: Parallel Programming**

Module ID	Workload	Credits	Semester	Frequency of Offering	Duration
MI21	150 h	5	2	yearly	1 semester

Workload	Attendance	Preparation and Follow-Up	Private Study	Preparation for Exam and Exam	Total
SU	30 h / 2 SWS	15 h	35 h	10 h	
P	30 h / 2 SWS	30 h			
Total	60 h / 4 SWS	45 h	35 h	10 h	<b>150 h</b>

**1 Scheduled Group Size:** SU: 35 students, P: 15 students

**2 Subject Knowledge / Skills**

*The students know various parallel programming techniques for shared memory multicore/multiprocessor systems and distributed or hybrid memory systems. Upon completion of the course they can implement solutions for problems which require multiprocessor performance or even networked computers. Usually all programs must be implemented in the programming language C under a UNIX-like operating system (Cygwin, Linux, Mac OS X, Solaris, ...).*

**3 Content / Syllabus**

*Today's problems (weather or earthquakes forecasting, crash test simulations, development of new medicaments or new materials, managing data in search engines, ...) require a huge computing power and large storage capacities, which generally can only be provided by high-performance computer systems or even networked computers. These systems can only be used efficiently for these kinds of problems with parallel programs. This course pinpoints a profound knowledge for some parallel programming techniques.*

- Basic principles and concepts
- OpenMP
- Message Passing Interface (MPI)
- Possibly GPGPU-programming

**4 Teaching Format**

*Lecture with integrated exercises and accompanying practical work in a laboratory*

**5 Prerequisites**

*None*

**6 Recommended Qualifications for the Participation**

*Excellent programming skills in C (mandatory), knowledge of Java and UNIX*

**7 Assessment**

*Written assignments which are presented orally.*

<b>8</b>	<b>Prerequisites for Granting ECTS Credits</b>  <i>Exam passed; regular participation in the laboratory.</i>
<b>9</b>	<b>Usage of this Module in Other Degree Courses</b>  <i>None</i>
<b>10</b>	<b>Contribution to Final Score</b>  5,56 %
<b>11</b>	<b>Convenor</b>  Professor of Operating Systems and Parallel Computing
<b>12</b>	<b>Language of Instruction</b>  <i>English</i>
<b>13</b>	<b>Reading List</b> <ul style="list-style-type: none"> <li>• <i>Chapman, B.; et al.: Using OpenMP: Portable Shared Memory Parallel Programming. The MIT Press, Cambridge, Massachusetts, 2008.</i></li> <li>• <i>Gaster, B.R.; et al.: Heterogeneous Computing with OpenCL. Morgan Kaufmann, Amsterdam, 2012.</i></li> <li>• <i>Kirk, D.B.; Hwu, W.W.: Programming Massively Parallel Processors - A Hands-on Approach. Elsevier, Amsterdam, 2010.</i></li> <li>• <i>Pacheco, P. S.: Parallel Programming with MPI. Morgan Kaufmann, San Francisco, CA, 1997.</i></li> <li>• <i>Pacheco, P. S.: An Introduction to Parallel Programming. Morgan Kaufmann, Burlington, MA, 2011.</i></li> </ul>