

<b>High-Performance Computing on Clusters</b>					
<b>Module-No./Abbreviation</b>	<b>Credits</b>	<b>Workload</b>	<b>Term</b>	<b>Frequency</b>	<b>Duration</b>
CE-WP26/HPCC	6 CP	180 h	3 <sup>rd</sup> Sem.	Winter term	1 Semester
<b>Courses</b> High-Performance Computing on Clusters			<b>Contact hours</b> 4 SWS (60 h)	<b>Self-Study</b> 120 h	<b>Group Size:</b> No Restrictions
<b>Prerequisites</b> -					
<b>Learning goals / Competences</b> After successfully completing the module, the students <ul style="list-style-type: none"> <li>• are enabled to design and create programs for parallel computing clusters,</li> <li>• can critically evaluate distributed-memory systems and programming patterns,</li> <li>• can assess the mathematical properties of iterative solvers and their scalability.</li> </ul>					
<b>Content</b> The lecture deals with the parallelization on cluster computers. Distributed-memory programming concepts (MPI) are introduced and best-practice implementation is presented based on applications from scientific computing including the finite element method and machine learning. Special attention is paid to scalable solvers for systems of equations on distributed-memory systems, focusing on iterative schemes such as simple splitting methods (Richardson, Jacobi, Gauß-Seidel, SOR), Krylov-methods (Gradient descent, CG, BiCGStab) and, in particular, the multigrid method. The mathematical foundations for iterative solvers are reviewed, suitable object-oriented interface structures are developed and an implementation of these solvers for modern parallel computer architectures is developed. Numerical experiments and self-developed software implementations are used to discuss and illustrate the theoretical results.					
<b>Teaching methods / Language</b> Lecture (2h / week), Exercises (2h / week) / English					
<b>Mode of assessment</b> Written examination (120 min, 100%)					
<b>Requirement for the award of credit points</b> Passed final module examination					
<b>Module applicability</b> MSc. Computational Engineering, MSc. Bauingenieurwesen, MSc. Angewandte Informatik					
<b>Weight of the mark for the final score</b> 6 %					
<b>Module coordinator and lecturer(s)</b> Prof. Dr. A. Vogel, Assistants					
<b>Further information</b>					