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<tr><td><b>Course code</b></td><td></td></tr>
<tr><td><b>Type and description</b></td><td>EC</td></tr>
<tr><td><b>ECTS credit</b></td><td>1</td></tr>
<tr><td><b>Course name</b></td><td>General-purpose computing on graphics processing units</td></tr>
<tr><td><b>Course name in Polish</b></td><td>Obliczenia na procesorach graficznych</td></tr>
<tr><td><b>Language of instruction</b></td><td>English</td></tr>
<tr><td><b>Course level</b></td><td>8 PRK</td></tr>
<tr><td><b>Course coordinator</b></td><td>Piotr Napieralski</td></tr>
<tr><td><b>Course instructors</b></td><td>Dariusz Puchała</td></tr>
<tr><td><b>Delivery methods and course duration</b></td><td>
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<tr><th></th><th>Lecture</th><th>Tutorials</th><th>Laboratory</th><th>Project</th><th>Seminar</th><th>Other</th><th>Total of teaching hours during semester</th></tr>
<tr><td>Contact hours</td><td></td><td></td><td></td><td>15</td><td></td><td></td><td>15</td></tr>
<tr><td>E-learning</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td></td></tr>
<tr><td>Assessment criteria (weightage)</td><td></td><td></td><td></td><td>100%</td><td></td><td></td><td></td></tr>
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<tr><td><b>Course objective</b></td><td>Understanding and ability to use general-purpose computing on graphics processing units</td></tr>
<tr><td><b>Learning outcomes</b></td><td>Knowledge and ability to use general-purpose computing on graphics processing units
W4, U4, K1</td></tr>
<tr><td><b>Assessment methods</b></td><td>Presentation of the progress of work during the realization of the entire semester project and the assessment of partial and summary reports.</td></tr>
<tr><td><b>Prerequisites</b></td><td>Knowledge of C++ programming language, knowledge of data structures.</td></tr>
<tr><td><b>Course content with delivery methods</b></td><td>The aim of the course is to present and explain the most important issues related to the physical organization and programming of modern graphics processing units (GPUs) with application of CUDA and OpenCL libraries. The presented knowledge is aimed at gaining practical skills of programming highly efficient general purpose algorithms using available and popular programming tools. It should be emphasized that the contents of the subject</td></tr>
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	fully correspond to the contemporary trend of removing time consuming computational tasks from the CPU and transferring them to graphics processing units. During the course, students propose and implement their own solution to the problem that is strictly related to their research topics. In particular, the presented theoretical content is related to: 1. introduction to architecture and organization of graphics processing units by taking into account the hierarchy of resource availability from the level of threads, blocks and grids of blocks, 2. discussion of the mechanism of hiding memory latency, and the practical consequences of branch divergence, 3. basics of programming massively-parallel applications for graphics processing units with use of CUDA and OpenCL libraries, 4. introduction to two-dimensional grids of threads on the example of image processing algorithms, 5. the concepts of local and global synchronization with multi-stage algorithms (fast linear transformation algorithms, calculating increasing sums, neural networks, etc.) as an example of a class of algorithms requiring inter-stage synchronization, 6. utilization of shared memory, 7. constant memory and atomic operations, 8. measurement of the execution time of algorithms dedicated for graphics processing units.
Basic reference materials	1. Course materials in the form of pdf files. 2. CUDA library documentation (available online). 3. J. Sanders, E. Kandrot, *CUDA by Example: An Introduction to General-Purpose GPU Programming*, Addison Wesley Pub Co Inc, 2010. 4. J. Han, B. Sharma, *Learn CUDA Programming: A beginner's guide to GPU programming and parallel computing with CUDA 10.x and C/C++*, Packt Publishing Limited, 2019.
Other reference materials	W. W. Hwu, D. B. Kirk, I. E. Hajj, *Programming Massively Parallel Processors*, Elsevier Science & Technology, 2022.
Average student workload outside classroom	10 h
Comments	
Last update	26.04.2023