



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
ул. „Сердика“ № 4
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Basic Information:

Course Title: **Introduction to Parallel Computing**

Lecturer: .Professor, Dr. Todor Gurov.

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Total Teaching Hours: 30

Annotation (up to 150 words)

The course “Introduction to Parallel Computing” introduces fundamental principles, models, and technologies for developing software that utilizes parallelism. It covers modern multiprocessor and multicore architectures, as well as key concepts such as concurrency, synchronization, and distributed computing. Students become familiar with programming models for shared and distributed memory, along with basic tools and libraries (e.g., OpenMP, MPI). Practical sessions focus on parallelizing algorithms and analyzing performance. The course provides essential background for developing efficient and scalable applications in scientific computing, big data processing, and artificial intelligence.

Course content (brief description by topics or modules)

Module 1: **Fundamentals of Parallel Computing.**

Module 2: **Models and Technologies for Parallel Programming.**

Module 3: **Performance and Applications.**

Teaching and assessment methods

15 lectures + 15 practical sessions

Continuous assessment (assignments and practical tasks) – 40%

Mini project – 30%

Final test or exam – 30%.

Competencies acquired as a result of training (3–5 points)

After completing the course, PhD students will be able to:

- understand fundamental concepts of parallel computing
- use basic parallel programming libraries (OpenMP, MPI)
- evaluate performance of parallel programs
- develop basic parallel applications

Literature:



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1. Grama, A., Gupta, A., Karypis, G., Kumar, V. – Introduction to Parallel Computing, Publisher: Addison Wesley, 2003, pp.856.
2. Pacheco, P. – An Introduction to Parallel Programming, Morgan Kaufmann Publishers, 2011.
3. Rauber, T., Rünger, G. – Parallel Programming for Multicore and Cluster Systems, Springer, 2010, pp.463.
4. Wilkinson, B., Allen, M. – Parallel Programming: Techniques and Applications, Second Edition, 2004

Additional information (optional) (e.g., special requirements, laboratory equipment, prior knowledge)

The course is suitable for PhD students with an interest in programming and/or the use of modern HPC systems. During practical sessions, they will have access to the supercomputer Avitohol at IICT-BAS. It is recommended that doctoral students have basic knowledge of programming languages such as C/C++, Python, MATLAB, and R. Knowledge of the Linux operating system is welcome.