Lomonosov Moscow State University (MSU)

www.msu.ru
Established in 1755 by the decree of Empress Elizaveta Petrovna
More than 40,000 students including 7,000 undergraduates
Over 5,000 specialists do the refresher courses
More than 6,000 professors and lecturers
About 5,000 scientific researchers
About 4,000 international students
MSU campus:
  • 1,000,000 m² floor area
  • 1,000 buildings and structures
  • 8 dormitories for over 12,000 students
MSU library system is one of the largest in Russia:
  • 9,000,000 books (2,000,000 in foreign languages)
  • 55,000 readers using 5,500,000 books a year
Supercomputer Centre: Lomonosov, Chebyshev, and BluGene/P
MSU Medical Centre
Faculty of Computational Mathematics and Cybernetics (CMC MSU)

Founded in 1970 by the outstanding Russian mathematician Andrey Tikhonov 1906-1993

1990-1999
Dmitry Kostomarov
Academician of RAS

Since 1999:
Dean
Evgeny Moiseev
Academician of Russian Academy of Sciences (RAS)
Basic facts about CMC MSU

18 Departments of graduating students
✓ Applied Mathematics - 6
✓ Cybernetics - 8
✓ Computer Science - 4

18 Research Labs

450 Professors, lecturers, scientific staff
✓ 11 academicians of RAS including Presidents of RAS
✓ 13 corresponding members of RAS

100 Doctor of Sciences in math and informatics

200 Candidates of sciences (PhD)

2300 Full time students

400 Enrolled students each year

200 Postgraduate students

100 Foreign students
Overview of CMC MSU

CMC MSU is targeted on preparing elite specialists in applied mathematics, informatics, and computer sciences.

CMC MSU incorporate a broad range of curricular and research interests.

Close interaction and feedback from stakeholders enable CMC MSU to correlate learning outcomes with modern trends in science and business.

CMC MSU represents both the long-time traditions of Lomonosov Moscow State University with its maturity and experience and the hopes of the newer generation with its vision toward the Future.

The high qualification of our staff and the combination of deep theoretical and practical experience ensure that our graduates are welcome at the leading research centers, industrial, commercial and other institutions.
CMC MSU computer facilities

- 7 computer Labs for common purposes
- 15 special computer Labs
- 350 PC available for students
- 40 servers,
  40 Tb data warehouse
- 2 multimedia rooms and Tikhonov Multimedia Centre
HPC Platforms available at CMC MSU

- **CMC MSU Blue Gene/P**
  - 2048 nodes, 27.8 TFlops

- **SKIF “Chebyshev”**
  - 625 Intel-based cluster, 60 Tflops

- **pSeries 690 Regatta**
  - 16 processors, SMP

- **Students terminals classes**

- **CMC Local network**

- **MSU network**

- **0.5 Petaflops Cluster “Lomonosov”**
CMC MSU Departments of Applied Mathematics

- Mathematical Physics
- Computational Methods
- Research Automation
- Computational Technologies and Modeling
- General Mathematics
- Functional Analysis and its Applications
CMC MSU Departments of Cybernetics

- Operations Research
- Optimal Control
- Nonlinear Dynamic Systems and Control Processes
- System Analysis
- Mathematical Methods of Forecast
- Mathematical Statistics
- Mathematical Cybernetics
- Information Security
CMC MSU Departments of Computer Science

- Computing Systems and Automation
- Algorithmic Languages
- System Programming
- Supercomputers and Quantum Informatics

Also:
- Teaching Department of Foreign Languages
CMC MSU Research Labs

- Mathematical Physics
- Computational Electrodynamics
- Inverse Problems
- Mathematical Methods for Image Processing
- Statistical Analysis
- Mathematical Modeling in Physics
- Difference Methods
- Heat and Mass Transfer Simulation
- Computer Systems
- Ternary Informatics

- Mathematical problems of Computer Security
- Computational Practice and Information Systems
- Computer Graphics and Multimedia
- Information Systems Security
- Open Information Technologies
- Programming Technologies
- Computational Modeling Tools
- Industrial Mathematics
COLLABORATION with FOREIGN IT COMPANIES

Microsoft
Intel
Samsung
Sun Microsystems
Computer Associates
Siemens
IBM
Hewlett-Packard
Oracle
SAP AG
Cisco Systems
Cadence
Nissan Motors etc.
CMC MSU Regular B.Sc. Training Programmes

BACHELOUR DEGREE programmes
4 years full time
240 ECTS

Applied Mathematics and Informatics:
1st stage of continuous curricula of integrated Master Programme including more than 20 trajectories.

Fundamental Informatics and Information Technologies:
Bologna-style Programme including 5 subprogrammes.
Bologna-style Master’s Programmes

MASTER’S DEGREE
(2 years full time, 120 ETCS)

- Software for Computer Networks
- Decision Engineering in Economics and Finance
- Information Security and Cryptography
- Mathematical and Computer Methods of Image Processing
- Mathematical Models of Complex Systems: Theory, Algorithms, Applications
- Mathematical Models and Methods in VLSI Design
- Parallel Programming Technology and HPC
- Open Information Systems
Integrated Master’s Programmes – I (starting 2015)

MASTER’S DEGREE (2 years full time, 120 ETCS)

I. Mathematical and computational methods for solving problems of natural science:

1. Computing technologies and modeling
2. Spectral theory of differential operators and control of distributed systems
3. Numerical methods and mathematical modeling
4. Computer methods in mathematical physics, inverse problems and imaging
5. Modern methods of mathematical modeling
Integrated Master’s Programmes – II (starting 2015)

II. Mathematical methods of information processing and decision making:

1. Operations research and actuarial mathematics
2. Discrete structures and algorithms
3. Discrete controlling systems and their applications
4. Statistical analysis and forecasting of risks
5. Information security of computer systems
6. The theory of nonlinear dynamical systems: analysis, synthesis and control
7. Mathematical methods of modeling and optimization techniques for control processes
8. Logical and combinatorial methods of data analysis
9. Mathematical methods of system analysis, dynamics and control
Integrated Master’s Programmes – III (starting 2015)

III. System programming and computer science:

1. Intelligent systems
2. Big data mining
3. Compiler technology
4. Programming technology
5. Supercomputer systems and applications
6. Distributed systems and computer networks
7. Quantum Informatics
PhD programmes (4 years full time)

01.01.02 — differential equations, dynamical systems, and optimal control;
01.01.05 — probability theory and mathematical statistics;
01.01.07 — computational mathematics;
01.01.09 — discrete mathematics and mathematical cybernetics;
05.13.11 — mathematical and program software for computing systems and computer networks;
05.13.18 — mathematical modeling, numerical methods, and program packages;
05.13.19 — methods and systems of information protection, information security.
MSU-SUNY Dual Degree Program (DDP)

Two higher education diplomas in four years of simultaneous study at CMC MSU and at SUNY Canton College of Technology (SUNY Canton):

- Training in economics and the BBA from SUNY
- B.Sc. in Applied Mathematics and Informatics from CMC MSU

The original approach of DDP is based on the combination of the following three components:

- course transfer
- teaching franchising
- SUNY system of distance education
International Mobility of Students and Lecturers

ERANET-MUNUDS and ERANET-Plus MSU projects
10 Master-level courses was suggested by CMC MSU

Exchange of students through joint internship programs

- ParisTech (EP, Mines, ENSTA), Boudreaux-1, Sofia-Antipolis
- Munich Technical University, Humboldt University of Berlin, Aachen, Tubingen, Jena, Hannover, Bremen, Bielefeld, etc.
- Technology University of Zurich, EPL at Lausanne
- Tor Vergata of Rome
Summer School-2012: 300 MSU students in China

- Summer School – 2012: Chengdu, Xian, Beijing
- Meeting of Li Keqiang and Victor Sadovnichii
- China-Russia strategic collaboration in science and education
International Scientific Activity

Summer students schools
- The Advanced Digital Sciences Center (Singapore-Illinois Univ.),
- ParisTech (France),
- EP at Lausanne (Switzerland),
- IIASA (Austria)

Joint scientific interactions and projects
- Minnesota, Hiroshima, Chuo, UKAEA Fusion, Montenegro, Seul, Comenius University in Bratislava, Bremen, Bielefeld, Barcelona HPC Centre etc.

Supported by RFBR-CNRS, RFBR-DAAD, RFBR-China
CMC MSU yearly International Schools

- **Youth Summer School**
  “High Performance Computing and Supercomputer Technologies”

- **The Rome-Moscow**
  "School on Matrix Computations and Applied Linear Algebra”

- **GraphiCon**
  International Conference on Computer Graphics and Vision and Youth School

- **International School**
  “Economic Growth: Mathematical Dimensions“

- **Modern Information Technologies and IT-education**

- **Information Technologies in Education**
Tempus-IV CMC MSU project

INFORMATICS AND MANAGEMENT:
BOLOGNA - STYLE QUALIFICATIONS FRAMEWORKS

Partners from EU:
1. Maria Curie-Sklodovska University [Lublin, Poland]
2. University of Koblenz-Landau [Koblenz, Germany]
3. Link Campus University [Rome, Italy]
4. TU of Kosice [Kosice, Slovakia]
5. Quality Assurance Netherlands Universities [Utrecht, Netherlands]
6. World University Service – Austrian Committee [Graz, Austria]

Partners from Russia:
7. Moscow State Humanitarian University
8. Lomonosov Moscow State University
9. State University of Management [Moscow]

and 10 Partners from Ukraine, 6 - from Armenia
Projects for Joint Collaboration with Stakeholders

Presented at International Fairs and Meetings in Paris, Berlin, Utrecht, Brazil
3D visualization and modeling for Space Industry

- **Special software for visualization of dynamic operations with receiving and decrypting of telemetric information during International Space Station flight.**

- **Special software of estimation solar battery effectiveness.**

- **Special software of estimation the luminance of manned spaceship interiors.**

Vasiliy Sazonov
sazonov@cs.msu.ru
The objective of the project is the development of mathematical modelling methods for personalized and realistic simulation of blood flow in human cardiovascular system. Project puts its contribution into the task of creation of computer monitoring, diagnostic and study of blood flow in human cardiovascular system.
Mathematical modeling of scattering properties of nanoparticles in different media

Yuri Eremin  eremin@cs.msu.ru  
Vladimir Lopushenko  lopushnk@cs.msu.ru

The Discrete Sources Method (DSM) is a new computer technology enables to realize a compact and effective computer models to treat a wide variety of light scattering problems including nanooptics, plasmonics and biophotonics.

DSM is a semi-analytical surface based meshless method, which requires neither a mesh generation, nor an integration procedure.

In the frame of the DSM there is an opportunity to evaluate an error of the solution obtained tracking real convergence of the results.
Security and Privacy of Future ITC for Mobile Devices

Dennis Gamayunov,
Acting Head of ISS Lab, CMC MSU
gamajun@cs.msu.su

- Research and develop formal models and tools for Future Internet ITC infrastructure which would assure level of security and privacy not lower than existing level of security and privacy of fixed networking devices.
- Develop methods for early detection and prevention of propagation of malware which targets mobile devices, web-based attacks (drive-by downloads of malware) as well as directed attacks at mobile operating system and applications.
- Develop mechanisms for minimizing consequences of successful remote device exploitation, prevent unauthorized use of infected, stolen or lost device from performing payment operations or other security-critical actions.
Short-time
International
Educational
Programmes
Student Training Programme

High Performance Computer Simulation for Science and Engineering

Director: Professor Vladimir Voevodin.
Total Length: 170 hours.
Period: 2-3 months.
Language: English.

Courses included:
1. Parallel Computing and Supercomputing Technologies (24 hours)
2. Applied Computing for Clusters and Supercomputers (48 hours)
3. New High Performance Scalable Algorithms for Computational Fluid Dynamics (48 hours)
4. Geometric Modeling in Computer Aided Design (CAD) (50 hours)

Advantages and Specific Features:
• Unique combination of novel high performance technologies and algorithms for engineering;
• Lecturers are the founders of Supercomputer Education in Russia.
Student Training Programme

Nonlinear Optimization and Operations Research in Economics

**Director:** Professor Alexander Vasin.  
**Total Length:** 126 hours.  
**Period:** 1-2 months.  
**Language:** English.

**Courses included:**  
1. Mathematical Models of Imperfect Competition (32 hours)  
2. Advanced Numerical Optimization (30 hours)  
3. Optimal Control: Linear Theory and Applications (64 hours)

**Advantages and Specific Features:**  
- a part of Master and PhD programs at IMPA, Rio de Janeiro, Brazil  
- partially based on original author’s books (in Portuguese)
Information Security Basics

**Director:** Dr. Ivan Chizhov.  
**Total Length:** 200 hours.  
**Period:** 2-3 months.  
**Language:** Russian/English.

**Advantages and Specific Features:**
- Well-established Programme of Information Security (IS) for a wide range of stakeholders;
- Unique combination of theoretical study and practice under supervision of leading IS tutors;
- Provides necessary background for CMC MSU 2-year Masters’ Programme “Information Security and Cryptography”.
THANK YOU!

More about CMC MSU:

http://cmc.msu.ru (In Russian)

http://en.cs.msu.ru (In English)