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# Data Science

MSc Program



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# Mathematical Modelling & Data-driven Simulations

Track

**2019/2020**

# Mathematical Modelling & Data-driven Simulations

## Track at Skoltech

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- ***The main scope*** of this program track is to train students to develop and apply mathematical models and algorithms of scientific computing in fundamental science and industrial research and development relevant to Russian and worldwide industry. The program focuses on:
  - Mathematical Modeling (MM) and simulations
  - Fast and efficient numerical algorithms
  - High-performance computing (HPC)
  - Application of machine learning and data science in MM
- ***The applications' component*** of the program includes several important topics such as
  - Computational chemistry and materials modeling
  - Industrial Soft matter & Nanorobotics
  - Computational fluid dynamics and additive manufacturing
  - Seismic, geological and social modeling

# Objectives:

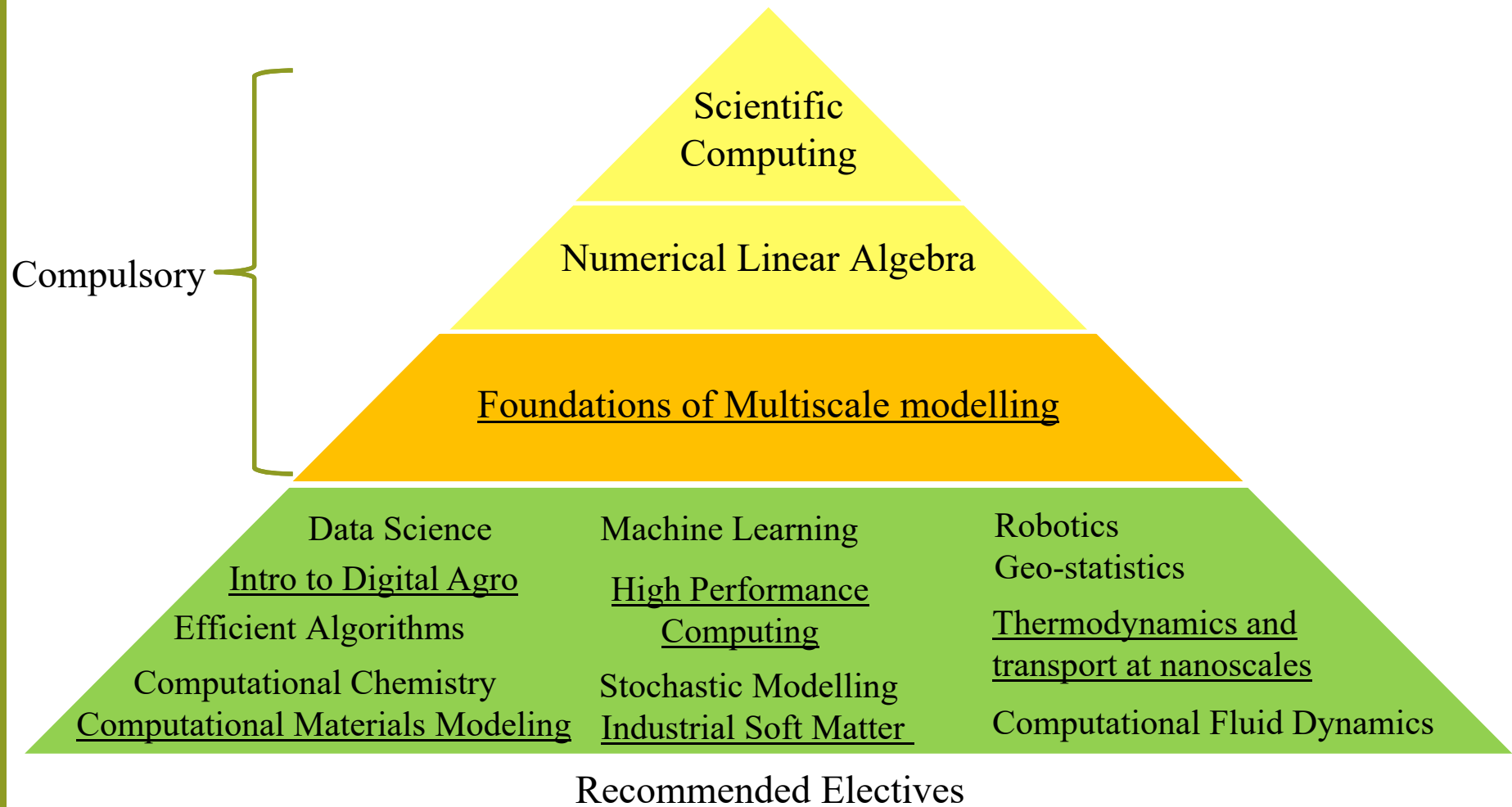
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To couple computational science and modern engineering:

- The curriculum of the program combines state-of-the-art engineering topics (high-performance computing, modern simulation software, etc.) with in-depth teaching of computational science foundations (numerical ODE and PDE, multiscale methods, modeling of stochasticity and Monte-Carlo methods, parallelization strategies, machine learning, etc.);
- Graduates are expected to possess a combination of deep knowledge of scientific computing background and practical engineering skills (software, algorithms, tools, etc.).

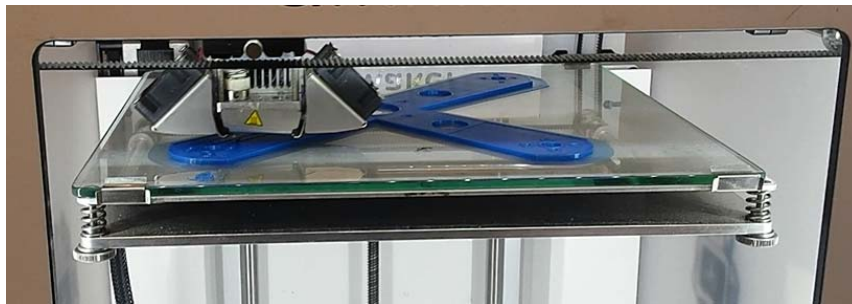
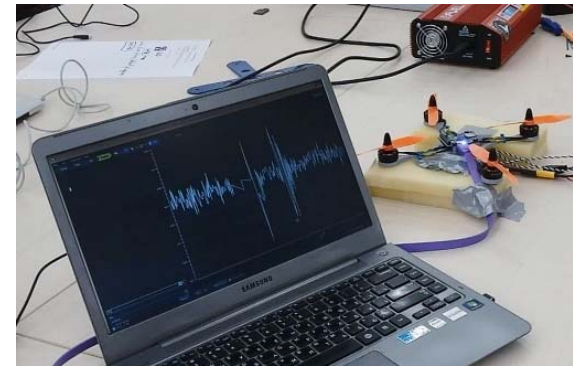
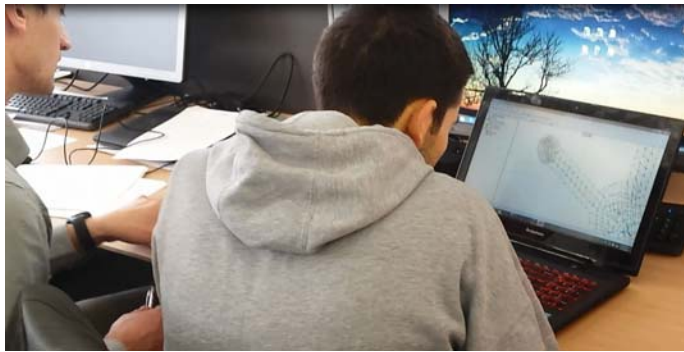
# Program Structure:

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# Modelling, Simulation and Discretization

- Solving differential equations and applying to real-world problems (e.g., vibration-proof quadcopter frame)
  - Project example: students design, 3D-print and test their frames



# Academic Partners

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The program has strong ties with leading Russian research & education centers:

- Moscow Institute of Physics and Technology
- Keldysh Institute of Applied Mathematics
- IITP RAS
- State University of Aerospace Instrumentation
- National research center “Kurchatov Institute”



# Research Projects and Thesis

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- Students are actively involved in research activity starting from Term 3.
- Main research directions:
  - Fast Solvers for Large Scale / High-Dimensional Problems
  - Next Generation Multiscale Modeling
  - Computational Chemistry and Materials Modeling
  - Industrial Soft matter & Nanorobotics
  - Numerical Optimization
  - Computational Prototyping
  - Utilization of machine learning in multiscale modelling
  - Crowd dynamics and traffic modelling



# Industrial Partners







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NATIONAL RESEARCH CENTER  
"KURCHATOV INSTITUTE"



# CSE Program: Job Market

	Sector	Examples
	<b>Aerospace, Advanced Manufacturing, Large-Scale Engineering Design</b>	Sukhoi, Energomash, RosNano, RusHydro, RosTec
	<b>TeleCom</b>	RosTeleCom, Huawei
	<b>Oil and gas</b>	Lukoil, Shlumberger, GazPromNeft
	<b>Pharma and Biotech</b>	Roche, Novartis
	<b>Skolkovo startups</b> (IT, TeleCom, and other)	Many (e.g. Datadvance)
	<b>Academic &amp; research Institutions</b>	Skoltech, National Research Centres, Supercomputer Centres (PhD, postdocs)