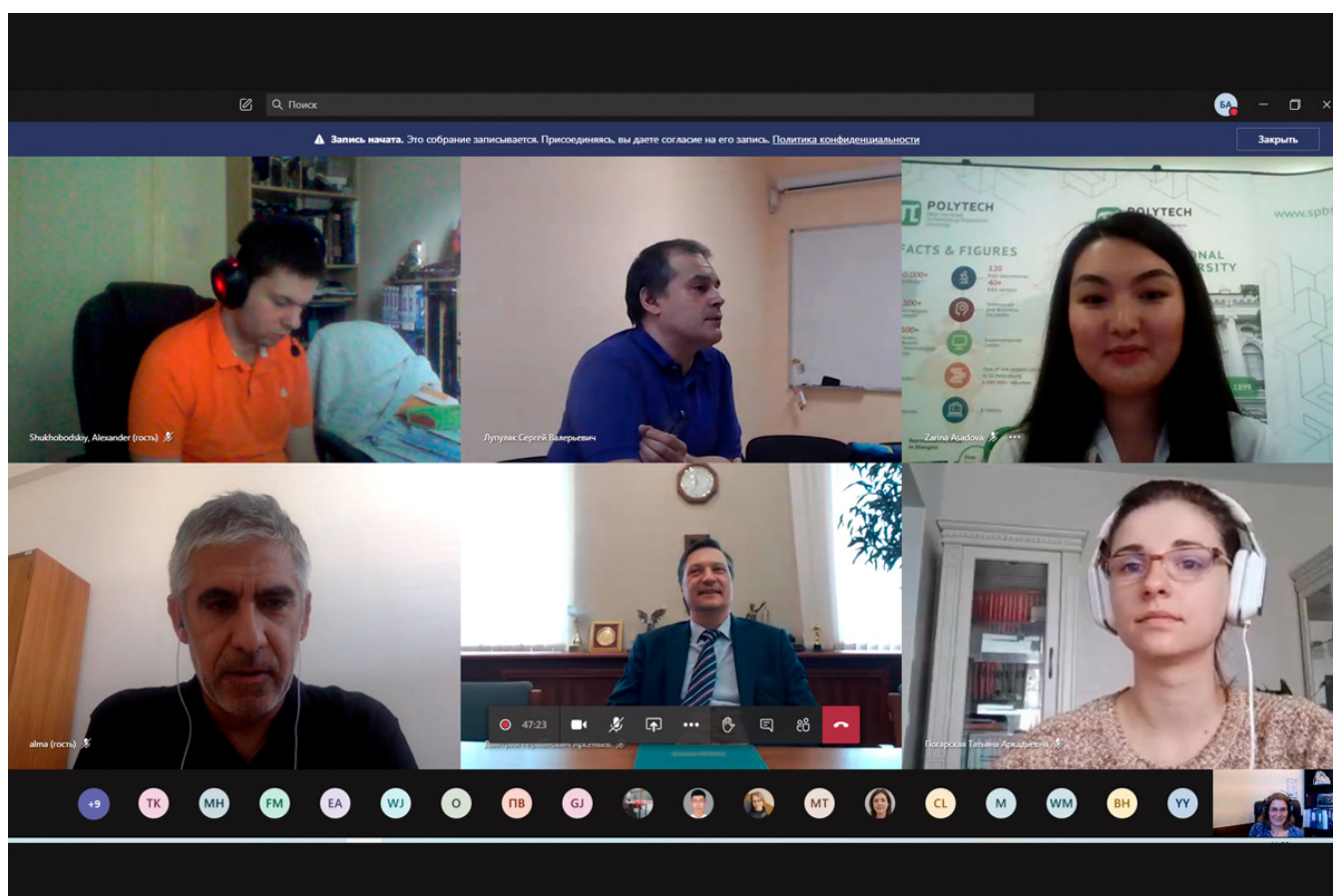


## ECMI Virtual Modeling Week kicked off at Polytechnic University

A landmark event for mathematicians, the International Modeling Week, took start at Polytechnic University. Let us remind you that our university was the first in Russia to have the opportunity to [host an event for young scientists](#) from around the world. Unfortunately, the coronavirus pandemic also made adjustments here: for the safety of participants, the Modeling Week virtualized and will be held as part of the [International Polytechnic Summer School](#). But next year, the event that has been held for more than 30 years under the auspices of the [European Consortium for Mathematics in Industry](#) (ECMI), Polytechnic University will host in a “live” format.



Dmitry Arsenyev, SPbPU Vice Rector for International Relations, addressed the participants with a welcoming speech. *“Although we cannot see each other in person, we are all still united by common ideas and values. One of them is the desire for knowledge, for new discoveries and achievements. We see this when we look at the number of participants from all over the world who have joined this year’s Modeling Week and other online summer school programs. The geography of participants is traditionally wide: students from China, France, Portugal, Italy,*

Serbia, Pakistan and other countries. I wish you all good luck and new discoveries,” said the Vice Rector.

On behalf of the European Consortium of Mathematics and Industry, ECMI President, Professor of the University of Coimbra (Portugal) Aderito ARAUGIO welcomed the audience and wished good luck and patience. “The key objective of the Modeling Week is to bring together outstanding young scientists from all over the world and to give them the opportunity to solve current and relevant problems from different fields. St. Petersburg is a great city for scientific discoveries. I am glad that, although virtually, all of us have gathered here,” said the President of ECMI.

Reduced problem formulation

Quadratic Programming (QP) problem

$$\min \left( \frac{1}{2} U^T \cdot K \cdot U - F^T \cdot U \right) \quad (A \cdot U)_i \leq g_i \quad i = 1, \dots, N$$

Reduced stiffness matrix

Forces from fasteners/rivets

Connections between nodes (node-to-node contact formulation)

Initial gap between parts

ASRP 2020

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Important goals of the organizers are to train students in mathematical modeling and to promote cooperation and communication skills in a multicultural environment. During the week, participants will work on applied problems under the guidance of instructors. A key feature of the Modeling Week is that students' projects reflect real-life needs and have every chance to be applied.

This year, young scientists will be expected to offer solutions to four problems. One of them is aimed at optimizing the bolt-joint process during aircraft assembly. Another challenge relates to the development of a hybrid storage system consisting of batteries, heaters and a water cylinder, which in the future will be able to meet peak demand and uneven energy consumption by households. The

third task will require participants to conduct a study of water absorption in wood, create a mathematical model of capillary water absorption and analyze the water content distribution in the trunk. In the long term, this will help to better understand the biomechanics of forests and make the world greener.

The fourth theme was poetically named “Stairs to Heaven”. The project is based on Richard A. Lovett’s short science fiction novel “Jack and Bean Stem”. The main character climbs up a 65000-kilometer-high tower (the beanstalk). It is believed that a tower of this size will allow shuttles to be launched on Mars, using only centrifugal force with minimal additional energy. The participants will need to conduct a technical audit of the project and answer the main question: will we be able to approach conquering Mars in the near future?

📄 🔍 Поиск

## Problem 3: 3D Dynamics.

Actually the axis of Earth’s rotation is not perpendicular to the plane of its orbit around the Sun, but is tilted by an angle of  $23^\circ$  (see the figure) . So the Shuttle can’t be launched in-plane with Earth’s orbit.

Please repeat the simulations from previous problem adding third dimension (3D model)

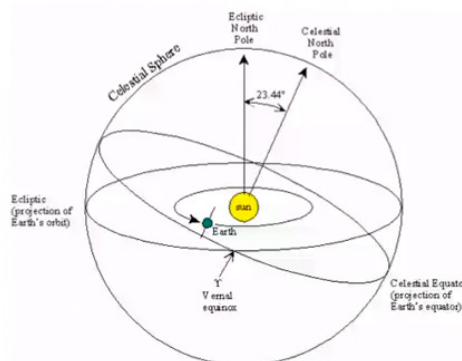


Figure is taken from <http://planetfacts.org/ecliptic/>

|| Приложение teams.microsoft.com предоставлен доступ к вашему экрану. [Закрыть доступ](#) [Скрыть](#)

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The teams will work on the MS Teams platform. All participants who will make the final presentation and submit the report will receive international certificates with ECTS credits.

*“During the Modeling Week, students are assigned to interesting and essentially practically important tasks, and no one imposes any specific solutions. Each participant comes with their knowledge and skills, and sometimes surprisingly bright ideas and very unusual solutions are born in teamwork,”* said one of the organizers of the Modeling Week on the Russian side, the head of the Laboratory of Virtual Simulation Modeling Institute of Applied Mathematics and Mechanics Sergei

LUPULYAK.

*“The tasks of ECMI are well aligned with the areas of IMPA research, where global projects related to the use of applied mathematics methods to non-standard industrial problems are very successfully implemented,”* stressed Maxim FROLOV, Director of the Institute of Applied Mathematics and Mechanics.

Prepared by the SPbPU International Office

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