LEPL G. Tsulukidze Mining Institute

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Rope System laboratory

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Head of Laboratory: PHD Giorgi Nozadze

Scientific research in the rope system laboratory 2020-2025 yy.

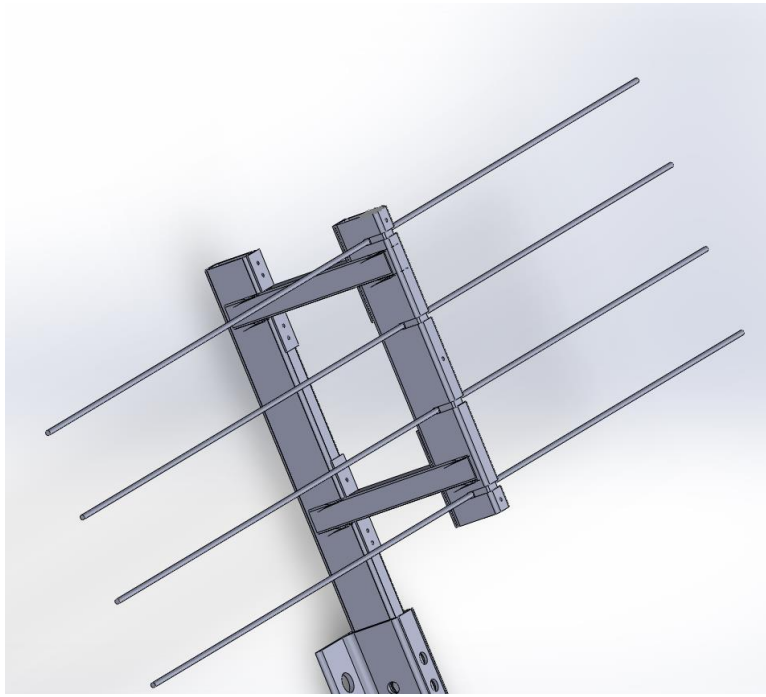
1. Development and research of new construction protective rope barriers for highways;
2. Experimental study of technical parameters of rope barrier;
3. Development of construction and engineering calculation scheme of rope-reinforced gabion protective wall;
4. Production of a test model of a small-capacity portable cargo ropeway;
5. Numerical modeling of the magnetic field potential of broken Wire
6. Calculation of a suspended rope under load conditions taking into account elastic elongation;
7. Design and calculation of parabolic reflector surface

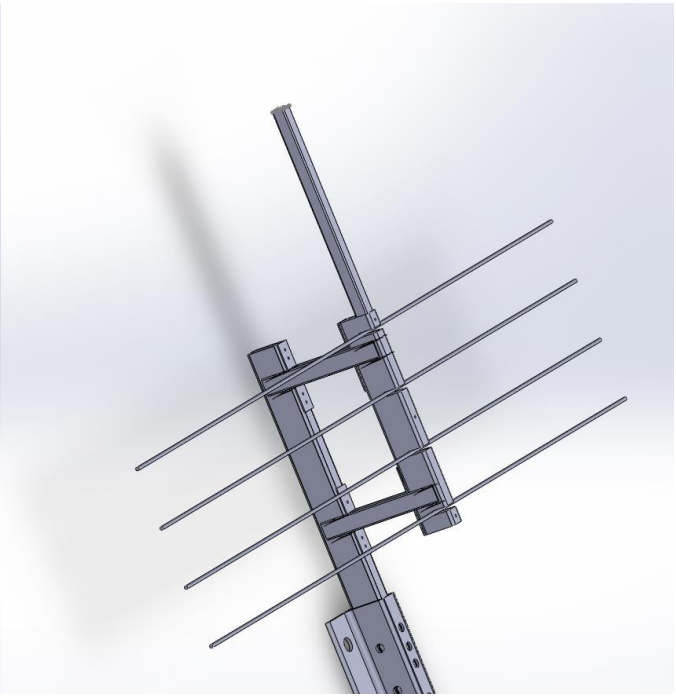
OUR RESULTS

1. Development and research of new construction protective rope barriers for highways;

Rope Barrier support system construction

- The structure is made of rectangular pipes and corrugated sheets of a common assortment.
- It is easy to install and is made in a prefabricated form;
- The foundation can be placed both in a reinforced concrete foundation and in rock and/or on other adjacent reinforced concrete structures;
- Installation of ropes penetrating the support body is facilitated;
- It is possible to provide moderately rigid fastening of the ropes to the support;
- It is possible to provide controlled rupture of the support.
- support element system have antivandal protection construction.



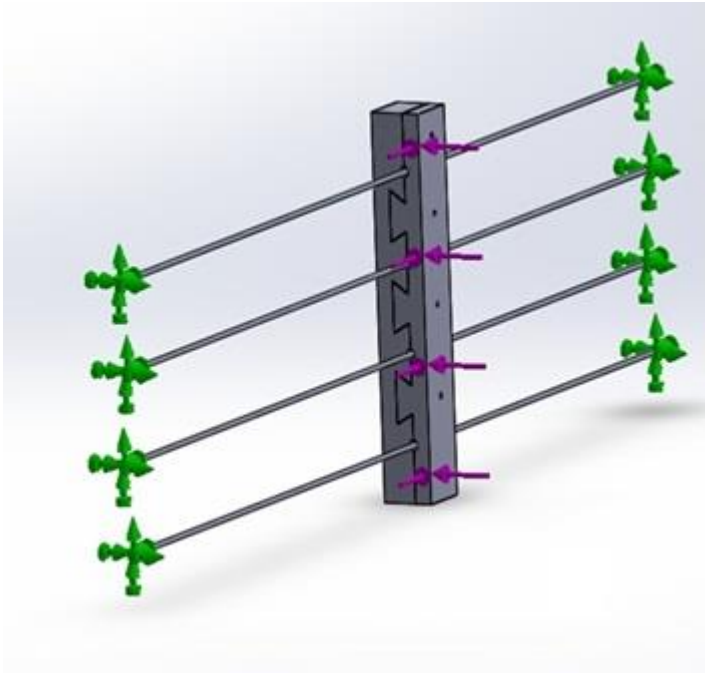


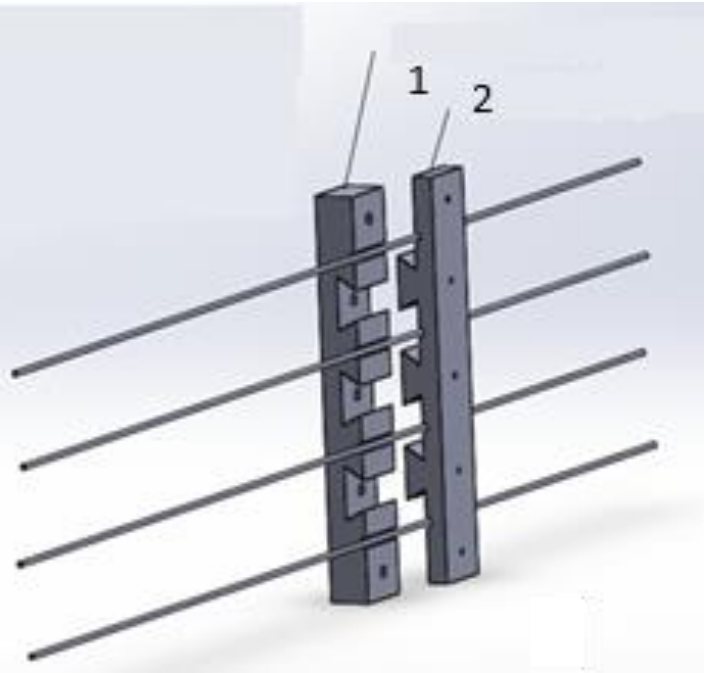
OUR RESULTS

1. Development and research of new construction protective rope barriers for highways;

Between support element construction

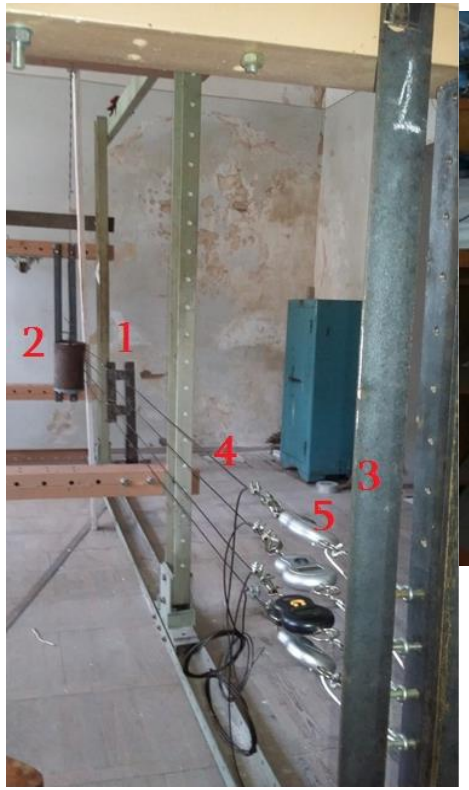
- The structure is made by plastic;
- It is easy to install and is made in a prefabricated form;
- It is possible to fix on a working place;
- Between support element system have antivandal protection construction.





OUR RESULTS

2. Experimental study of technical parameters of rope barrier



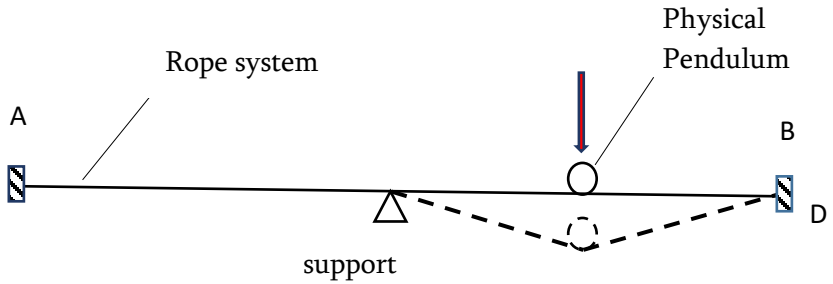
1. Barrier support;
2. Physical pendulum;
3. Support construction;
4. Steel rope D=6 mm;
5. Digital Dynamometry;

Purpose of the experiment:
Study of the distribution of impact energy of dynamic loading between the barrier ropes;

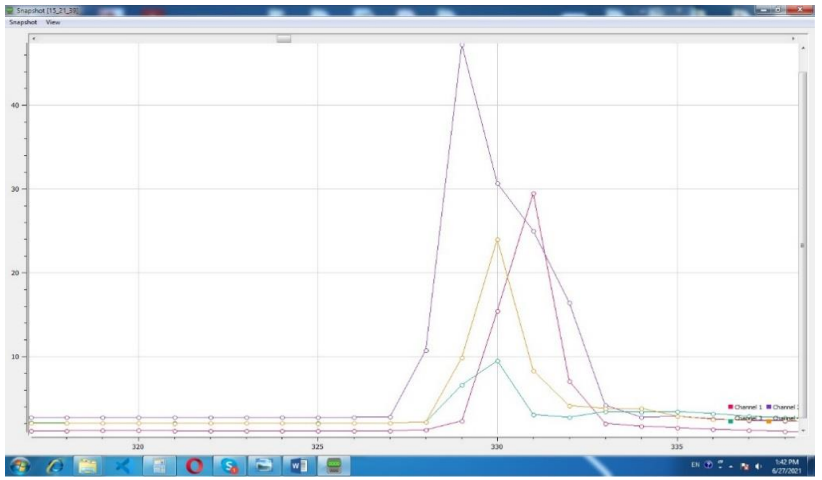
OUR RESULTS

2. Experimental study of technical parameters of rope barrier

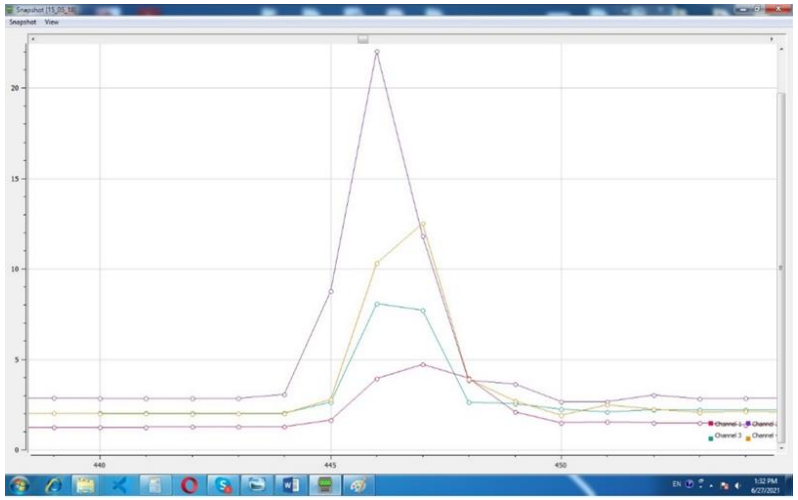
Experiment results:



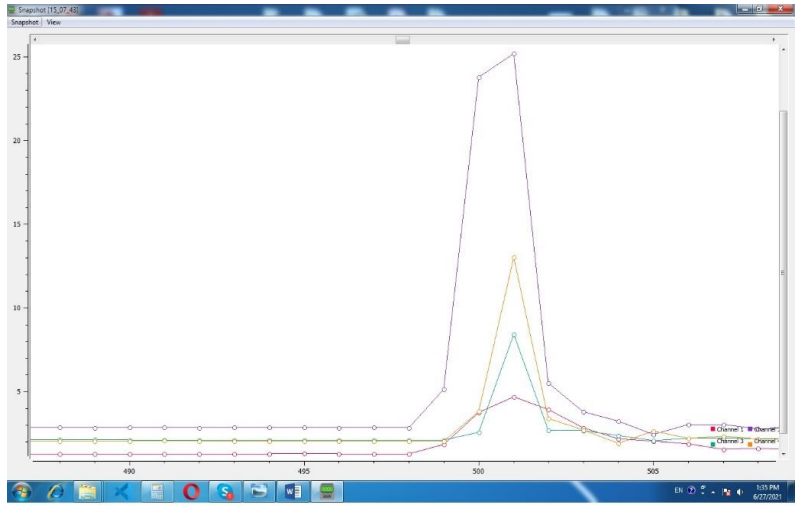
4. Pendulum energy: **17.10 Joul**:



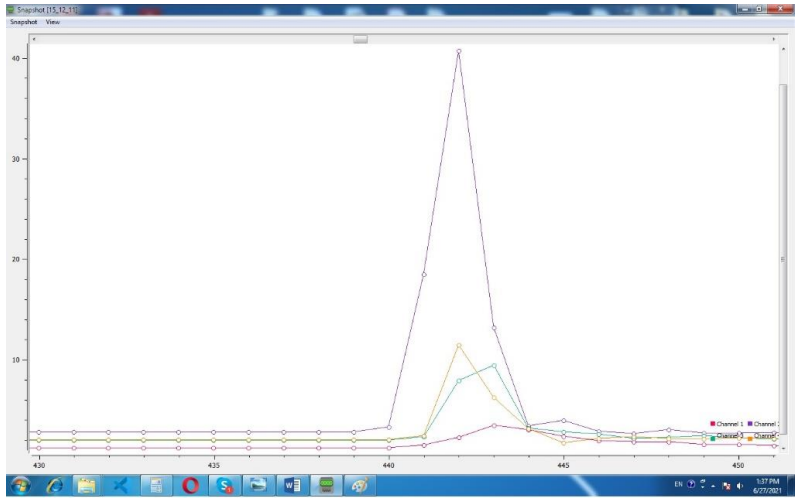
1. Pendulum energy: **4.27 Joule**



2. Pendulum energy: **8.54 Joule**



3. Pendulum energy: **12.81 Joule**

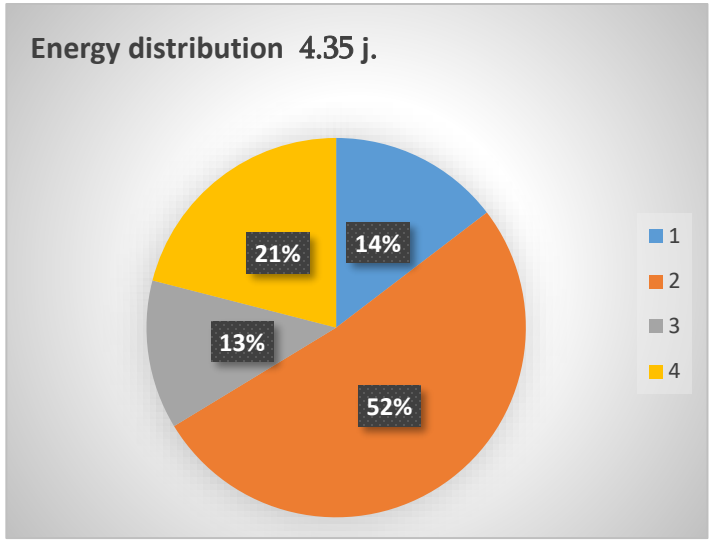


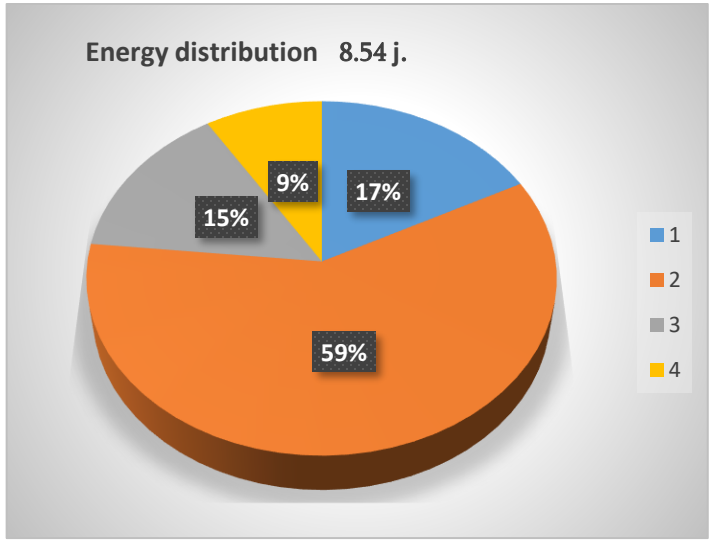
Impact force distribution between barrier rope

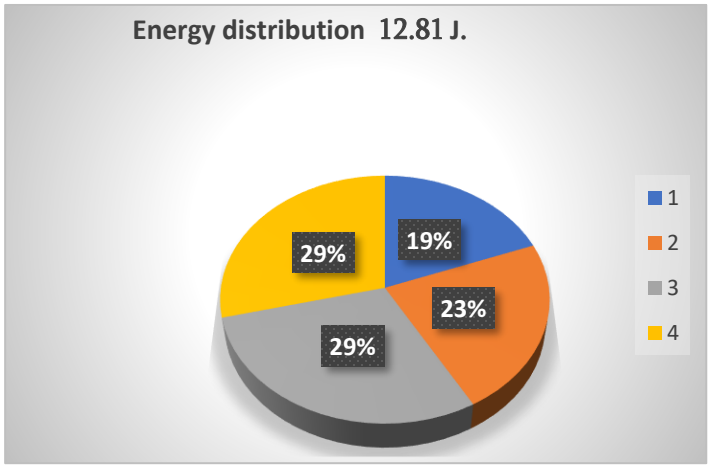
OUR RESULTS

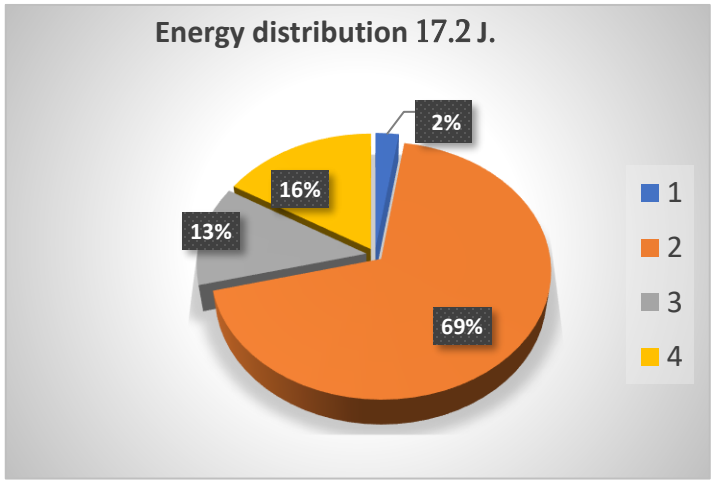
2. Experimental study of technical parameters of rope barrier

Experiment results:









1. Kinetical energy absorption by barrier rope have a probability character;

2. Maximum Kinetical energy Absorption by one rope was 69% of total Kinetical Energy;

3 Minimum Kinetical energy Absorption by one rope was 2% of total Kinetical Energy;

OUR RESULTS

Development of construction and engineering calculation scheme of rope-reinforced gabion protective wall

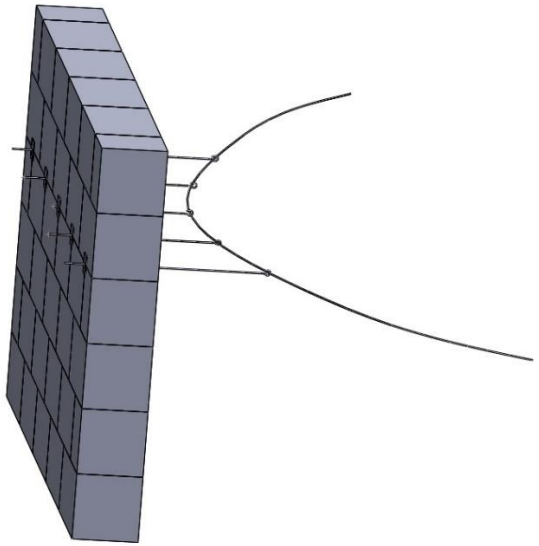
Way Gabions:
1. Gabion is easy end cheap building construction for build different tape of massive Protective walls;
2. For gabion building materials it is usually possible use on place stone and ground material;
3. Gabion walls have a good filtration characteristic;

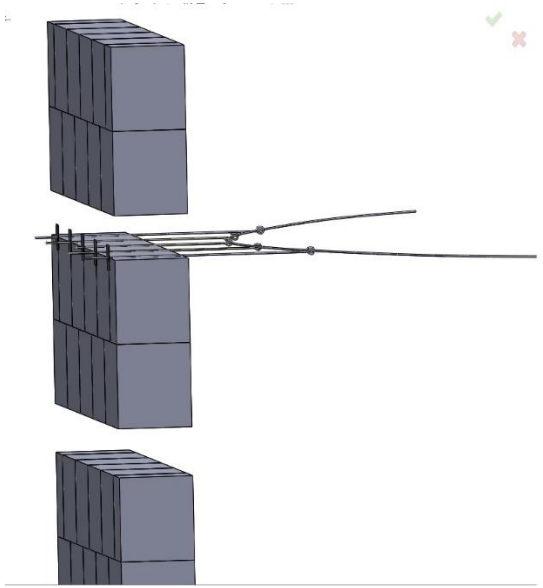
Problem: - Usually Gabion Protective walls have limited Height (6 meter) end not big load-bearing capacity .

Offer: - The height and load-bearing capacity of gabion retaining walls can be increased by using rope tension structures, which will increase the area of application of gabions.

OUR RESULTS

In our Laboratory was developed increase load-bearing capacity of protection gabion wall by using rope tension structures





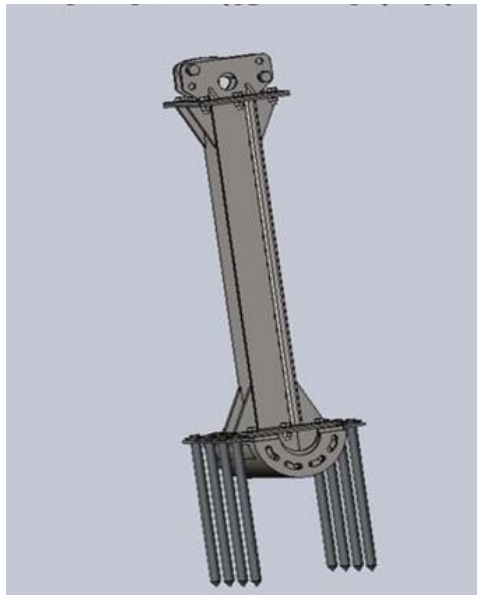
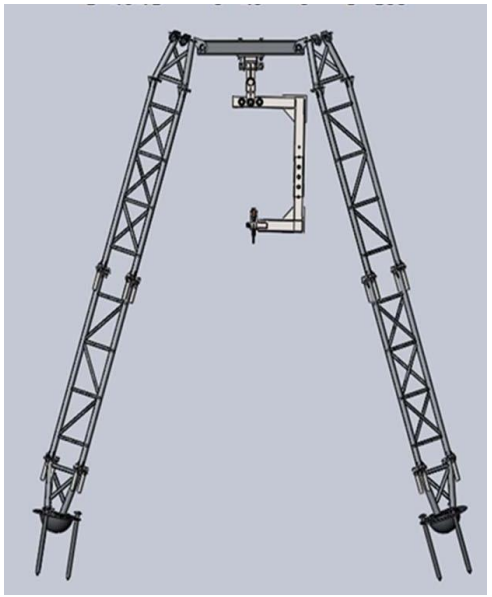
A structural solution for a rope-reinforced gabion wall was developed and an appropriate calculation EXCEL module was created.

The results obtained can be used in the design and construction of transport way infrastructure and river bank protection by gabion wall structures in mountainous regions.

OUR RESULTS

Realization of a test model of a small-capacity portable cargo ropeway

Design of small-capacity portable cargo ropeway

OUR RESULTS

Realization of a test model of a small-capacity portable cargo ropeway

Technical Data of ropeway

1. Nominal load capacity - 100 – 120 kg;
2. Nominal speed - 10 m/min;
3. Fuel tank capacity - 15 l.;
4. Electric drive type - asynchronous drive;
5. Electric drive power - 1.9 kW.
6. Transportation distance - up to 50 m (generally not limited).
7. Height difference - 12 m;
8. Horizontal distance - 45 m;
9. Cableway track inclination – 15°
10. Self-propelled wagon weight - 120 kg
11. Line equipment weight (1 station) - 75 kg;
12. Diameter of the traction rope
- Diameter of the synthetic rope - 10 -12 mm;
- Steel rope diameter 10 mm;

13. Rope strength reserve coefficient > 2;14. Operating tension in the rope < 5000

OUR RESULTS

Calculation of a suspended rope under load conditions taking into account elastic elongation

It is known that a suspended rope is a statically indeterminate structural element.
It is also known that a suspended rope under the influence of its own weight takes the form of a chain in space;

Force design calculations of rope systems are carried out using the parabolic method.

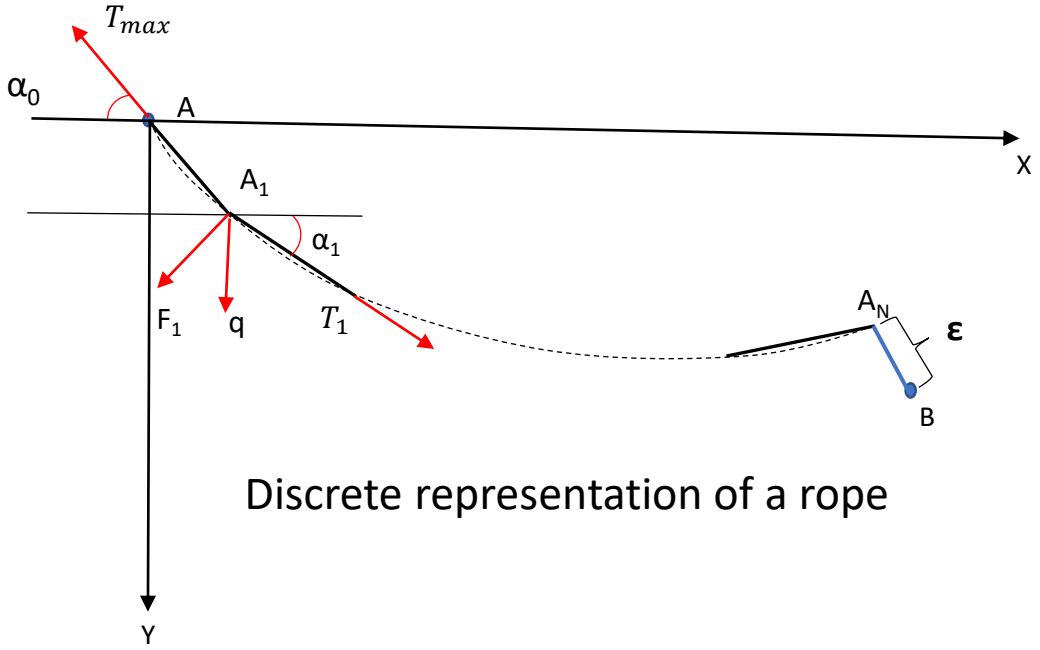
When in practice the issue of calculating rope systems caused by variously multiple point or distributed loads arises, the use of existing analytical methods is limited.

A special numerical method has been developed in the Ropeway Systems Laboratory for the geometric shape and force calculation of a multi-loaded ropeway system.

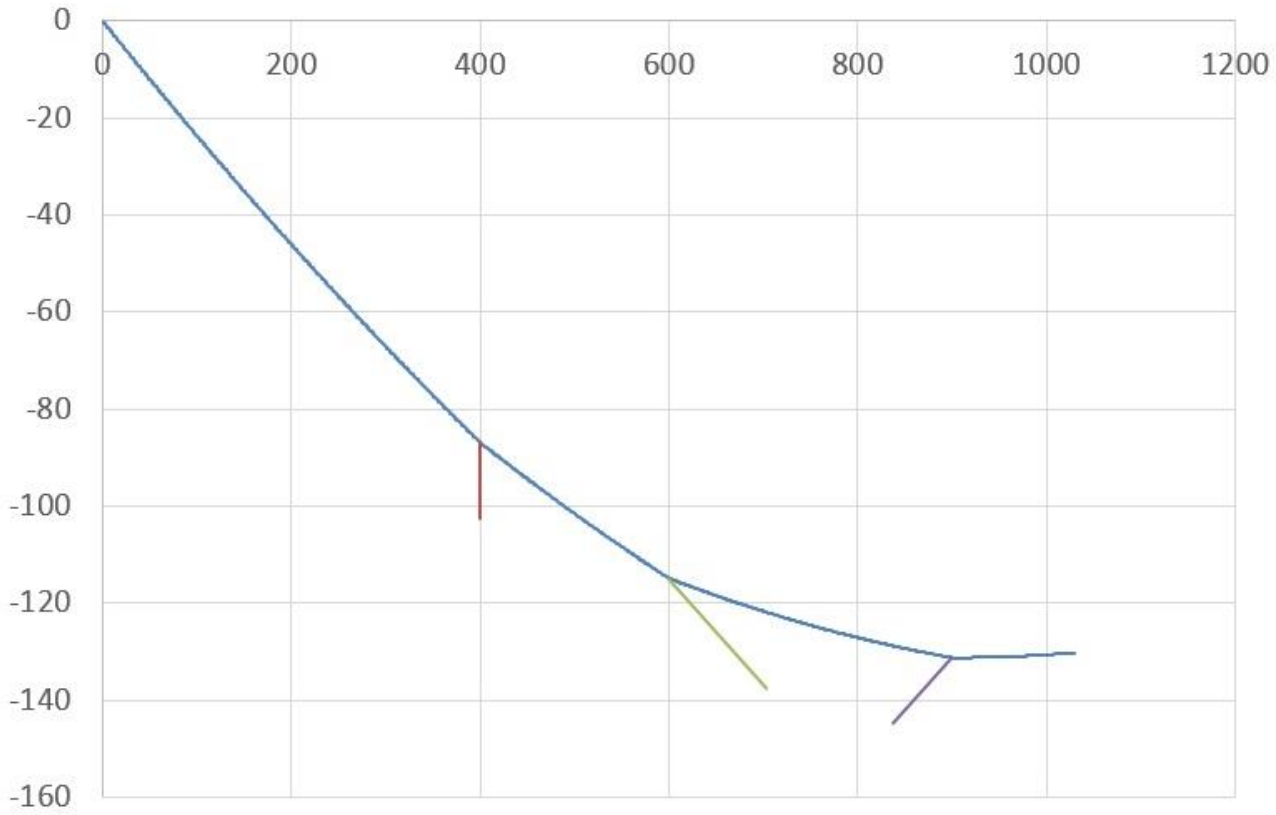
OUR RESULTS

Calculation of a suspended rope under load conditions taking into account elastic elongation

Calculation scheme



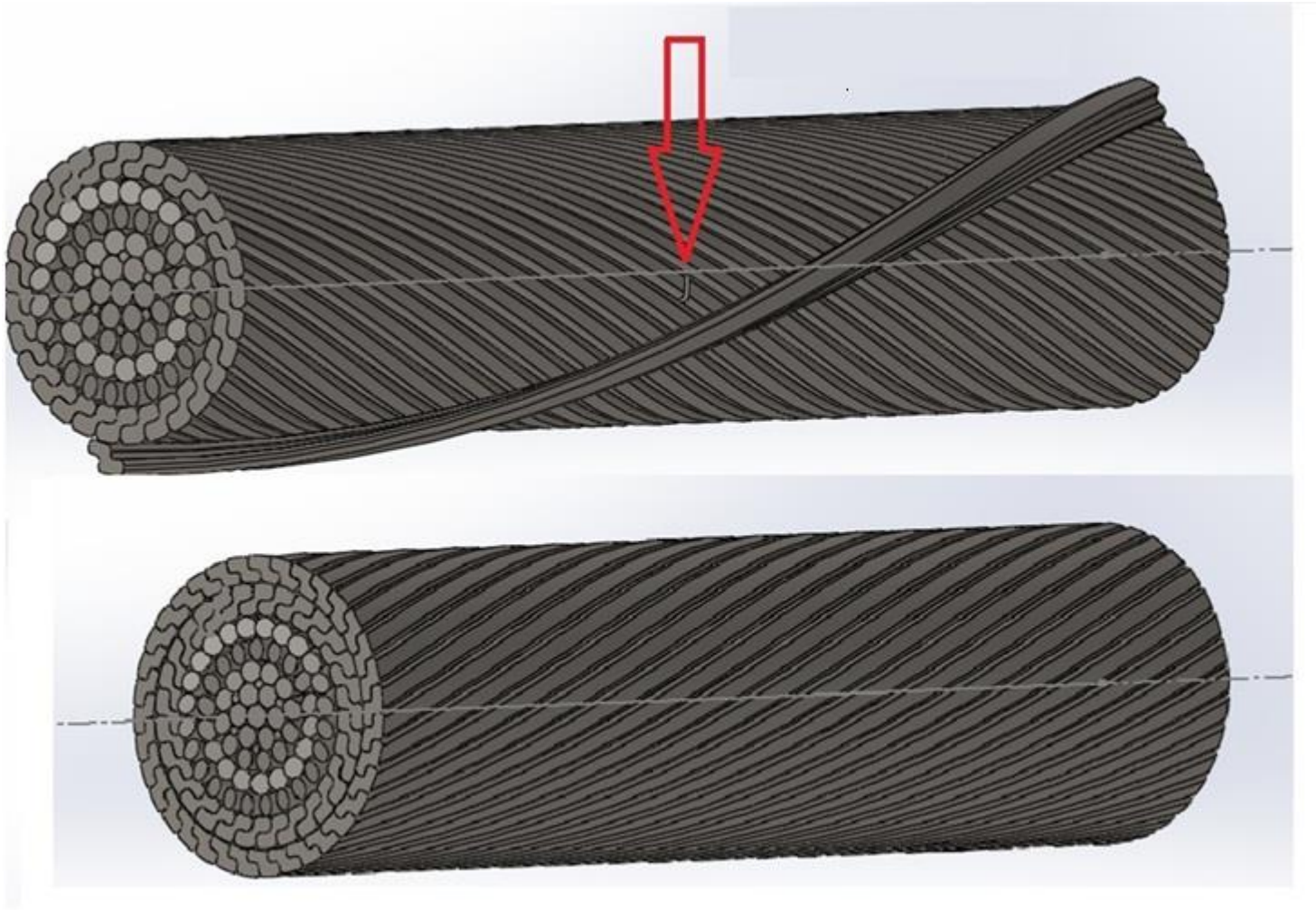
Discrete representation of a rope



Calculation result for 3 different point force activity

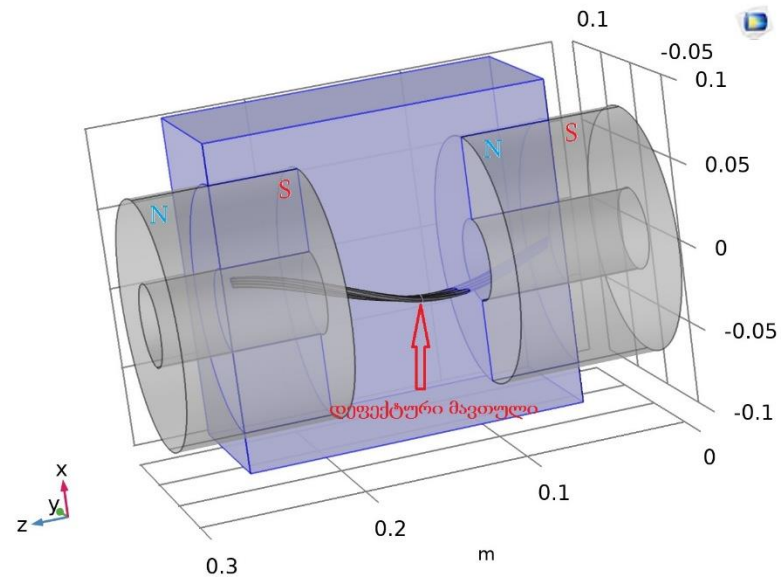
OUR RESULTS

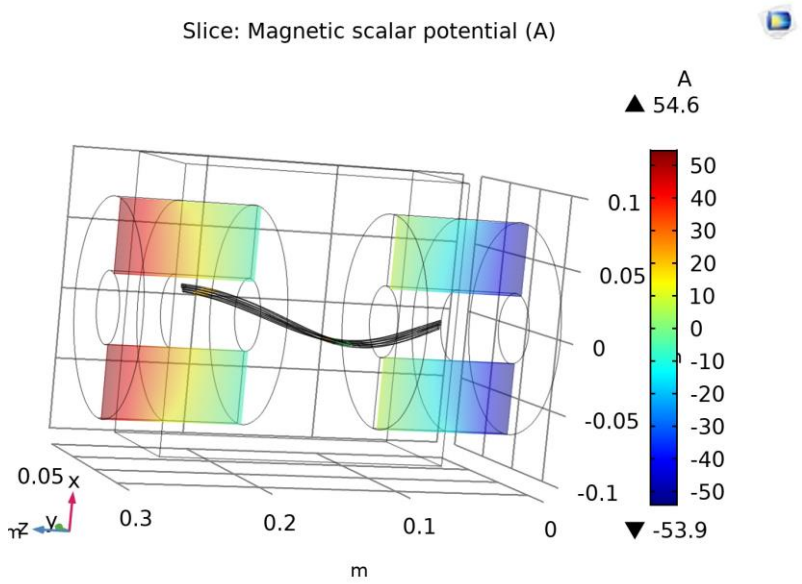
3D model of steel rope (Solidworks soft)

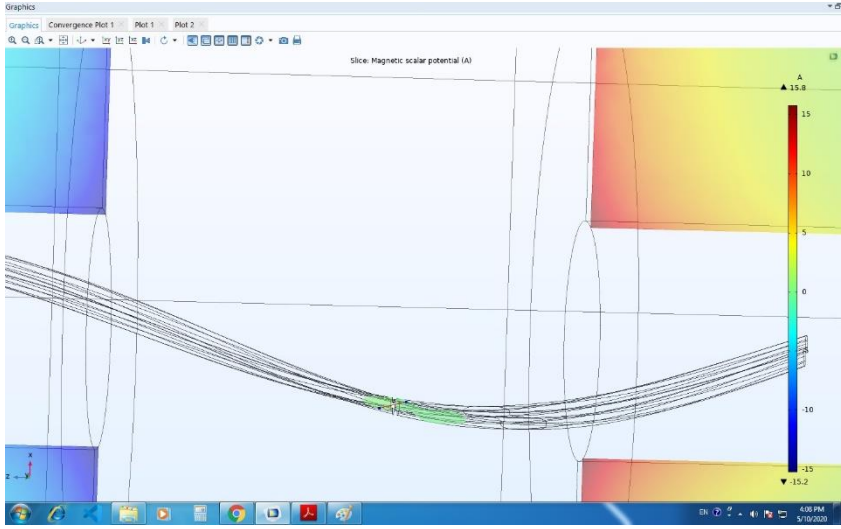


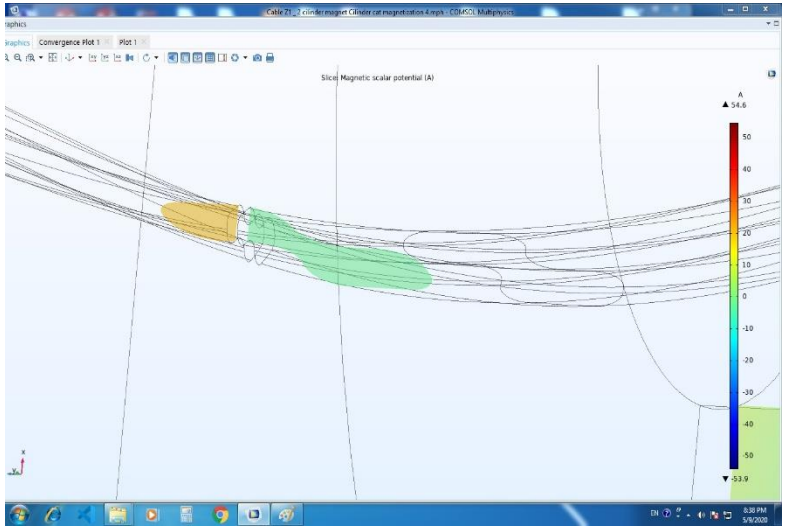
Numerical modeling of the magnetic field potential of broken Wire

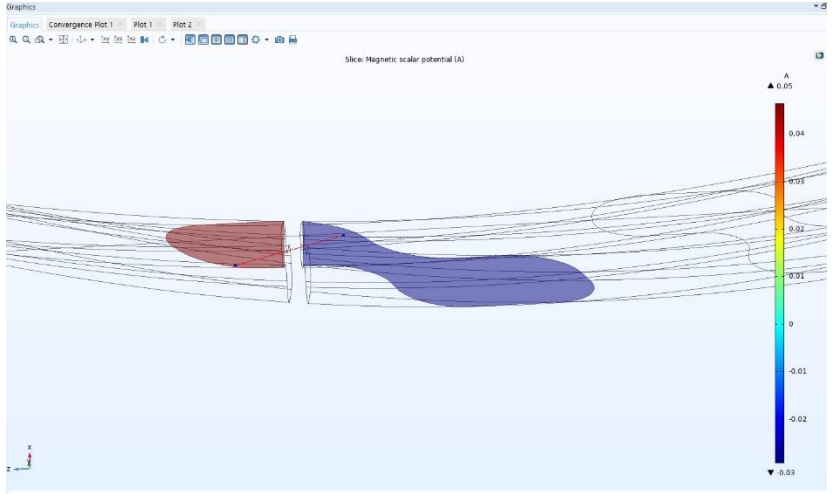
OUR RESULTS

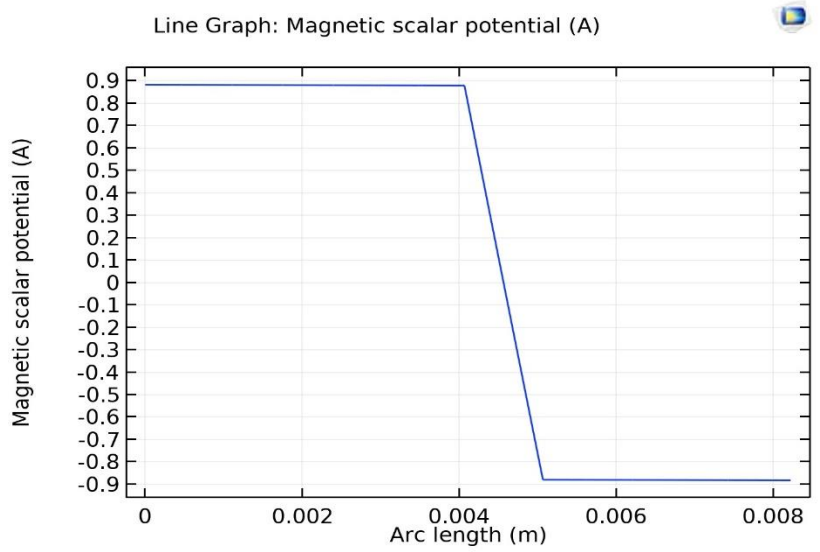




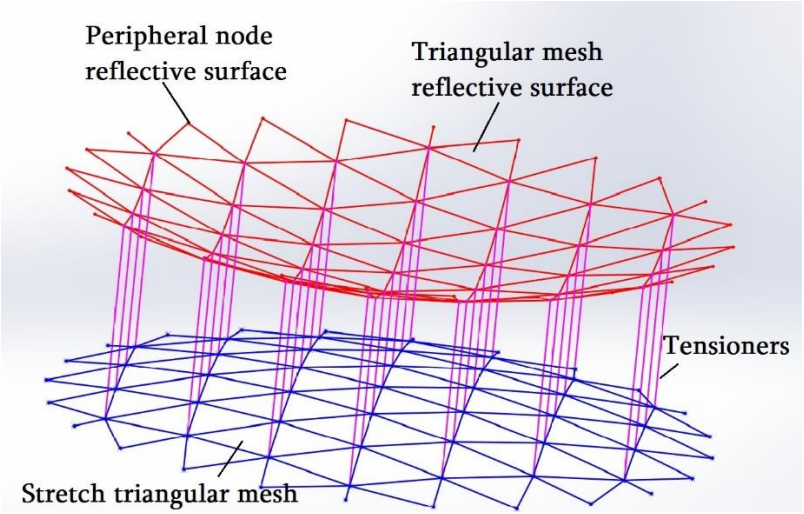


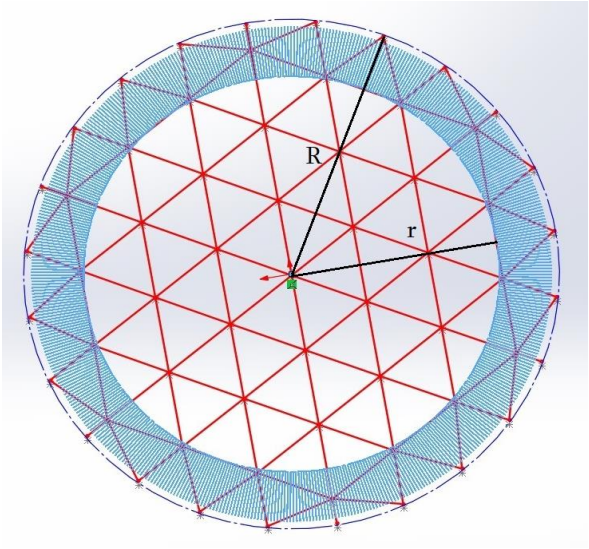


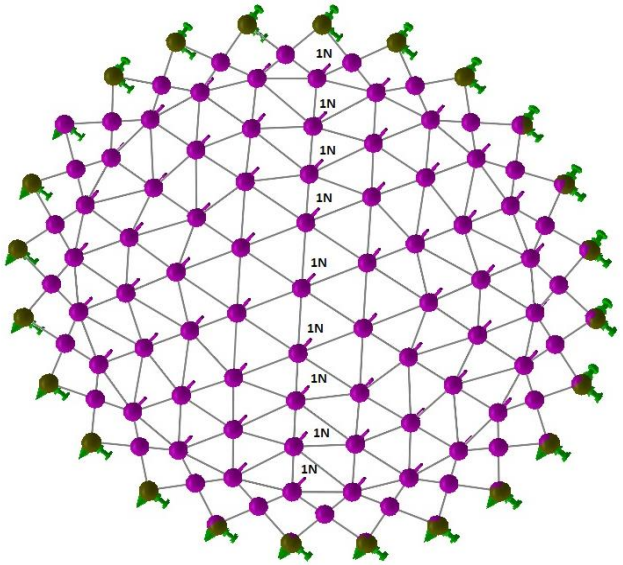


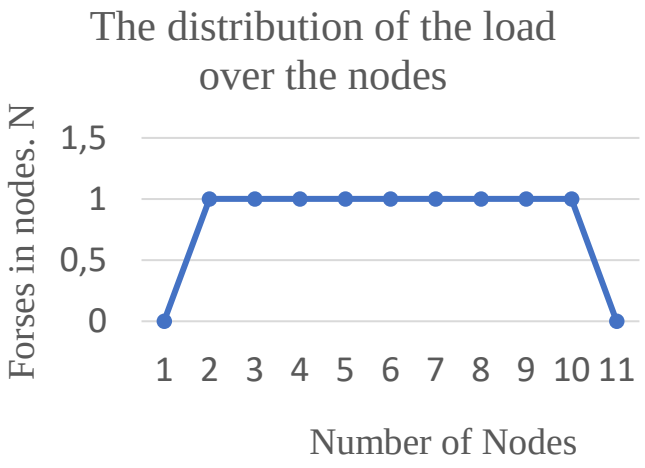


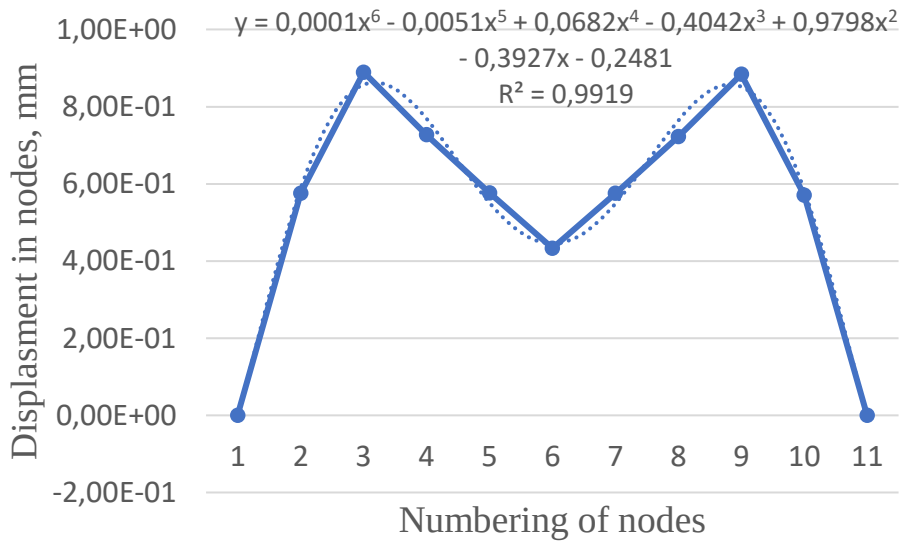
Research on the accuracy of flexible paraboloid surfaces of transformable reflectors using numerical modeling











Future plans and collaboration opportunities for the Rope Systems Laboratory

- Development and analysis of new ropeway systems;
- Development and improvement of non-destructive testing methods for steel ropes;
- Use of new materials in rope construction to increase their service life and technical characteristics;
- Large-scale coverings using rope systems;
- Lightweight portable rope systems and structures;
- Rope transport systems using renewable solar electric energy;
- Rope systems in coastal protection structures;
- Composite rope-rod systems;
- Use of modern software in the design and calculation of complex rope systems