

# Program of the training courses

## Using of Universal Mechanism software for simulation of dynamics of mechanical systems

### Annotation

Training lasts 5 days, 8 hours a day, totally 40 hours. Minimal requirements are computer class with computer projector for lectures and necessary working places for practical working. Universal Mechanism software as well as all used software (ANSYS, Pro/E, Autodesk Inventor, etc.) should be installed and available on computers. This training is oriented on participants who have basic knowledge in mechanics and computer literacy.

### Day 1

1.	<b>Review lecture.</b> Mechanical Engineering with Universal Mechanism software	2 hours
2.	<b><u>Lesson 1</u></b> <b>Lecture.</b> “General Principles of Working in Universal Mechanism: Rigid bodies, Joints, Forces”. <b>Practical training.</b> Creating a model of pendulum according to a lesson from “Getting Started” series.	1,5 hours
3.	<b><u>Lesson 2</u></b> <b>Lecture.</b> “Force Elements in Universal Mechanism: Bipolar and Linear Forces”. <b>Practical training.</b> Creating a model of an oscillator according to a lesson from “Getting Started” series.	1,5 hours
4.	<b><u>Lesson 3</u></b> <b>Lecture.</b> “Force elements in Universal Mechanism: Contact and Special Force Elements”. <b>Practical training.</b> Creating models with contact and special forces.	1,5 hours
5.	<b><u>Lesson 4</u></b> <b>Lecture.</b> Effective work in UM Base: animation and graphical windows, wizard of variables, list of variables, tips and tricks. <b>Practical training.</b> Studying samples and creating simple models in UM software.	1,5 hours

### Day 2

1.	<b>Review lecture.</b> “Simulation of Railway Vehicle Dynamics in Universal Mechanism Software”. Discussion that is devoted to features of creating models of railway vehicles and various questions of its simulation.	2 hours
2.	<b><u>Lesson 1. Practical training.</u></b> Creating a model of a wheelset according to a lesson from “Getting Started” series.	1 hour
3.	<b><u>Lesson 2. Practical training.</u></b> Creating the model of the rail car according to a lesson from “Getting Started” series.	2 hours
4.	Modeling of a traction drive, features of modeling different parts of railway vehicles are discussed. Individual tasks with further review of analysis.	3 hours

### Day 3

1.	<b>Review lecture.</b> “Simulation of Road Vehicles in Universal Mechanism Software”.	1 hour
2.	<b>Practical training.</b> Simulating road vehicle dynamics according to a lesson from “Getting Started” series.	1.5 hours
3.	<b>Practical training.</b> Performance-based assessments of heavy road vehicles in Universal Mechanism software.	1.5 hours
4.	<b>Lecture.</b> Scanning and parametrical optimization of mechanical systems using Universal Mechanism software. Service of distributed calculations. Mechanical systems: dynamical criteria, parameters, functional. Discussion.	1 hour
5.	<b>Practical training.</b> Practical using of scanning based on a lesson from “Getting Started” series.	1 hour
6.	<b>Free training.</b> Considering user’s models, questions&answers, discussion	2 hour

### Day 4

1.	<b>Lecture.</b> Simulation of flexible bodies in UM software: general principles and “how to...”. Considering flexibility of some parts of mechanisms on results of computer simulation, using flexible parts in railway and road vehicles.	1 hour
2.	<b>Practical training.</b> Creating models of a slider-crank mechanism and an electric motor on a flexible platform.	1.5 hours
3.	<b>Lecture.</b> Simulation of train dynamics in UM software. Discussion.	1 hour
4.	<b>Practical training.</b> Creating train models according to a lesson from “Getting Started” series.	1.5 hours
5.	<b>Free training.</b> Free work under the instructor’s supervision, considering user’s models, questions&answers, discussion.	2 hours

### Day 5

1.	<b>Lecture.</b> Matlab/Simulink interface in UM software. How to... <b>Practical training.</b> Creating models of controlled inverted pendulum and electric motor according to a lesson form “Getting Started” series.	1.5 hours
2.	<b>Lecture.</b> “Data import from CAD programs (Pro/E, Autodesk Inventor), live demonstration based on user’s model.”	1.5 hours
3.	<b>Lecture.</b> “Durability analysis in UM software”. Review of approaches and techniques.	1 hour
4.	<b>Free training.</b> Free work under the instructor’s supervision, considering user’s models, questions&answers, discussion.	3.5 hours
5.	<b>Closing the training.</b>	0.5 hour