RTU Course "Robot Kinematics"

31000 Faculty of Civil and Mechanical Engineering

General data

Code	MTM208
Course title	Robot Kinematics
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Jānis Vība
Academic staff	Marina Čerpinska Olga Kononova
Volume of the course: parts and credits points	1 part, 4.5 credits
Language of instruction	LV, EN
Annotation	The study course provides an overview of kinematics of robot mechanisms. Topics include planar kinematics, parallel kinematics and spatial kinematics. Study course introduces students with the following robotized solutions: manipulators, moving platforms, tracked machines.
Goals and objectives of the course in terms of competences and skills	The objective of the study course is to provide understanding and practical skills required for a student to be able to analyse the most widely applied schemes of robotized system (manipulator and mobile systems) technical solutions, as well as to synthesize them. To achieve the goal the following objectives are set: - to provide knowledge about kinematics of robot mechanisms; - to develop skills of using vectors and matrix calculus for kinematic tasks; - to develop skills in using specific software for kinematic tasks.
Structure and tasks of independent studies	During the study course students prepare two projects: 1) task on parallel kinematics; 2) task on spatial kinematics. Each project consists of two parts: 1) solution using matrix calculus; 2) graphical representation of the obtained solution using software.
Recommended literature	Obligātā/Obligatory: J. J. Craig. Introduction to robotics: mechanics and control, Addison-Wesley, any edition starting from 2nd, 1955-2006. J. Wittenburg, Kinematics, Theory and Applications, Springer, 2016. Papildu/Additional: R. L. Norton, Kinematics and dynamics of machinery, McGraw-Hill, 2009. X-J. Liu, J. Wang. Parallel Kinematics, Type, Kinematics and Optimal Design, Springer, 2014. O. Kepe, J. Vība, Teorētiskā mehānika, Rīga, Zvaigzne, 1982.
Course prerequisites	Calculus, Physics, Classical Mechanics.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction, coordinate systems, technical solution record.	4	2	1	8
Robotized manipulators and their schemes.	4	2	1	8
Manipulator statics and equilibrium.	6	2	1	8
Vector calculus for robots.	8	6	1	8
Manipulator kinematics, matrix calculus.	6	15	1	16
Mobile robot kinematics using software.	8	15	1	24
Mobile robotized platforms and their schemes.	8	6	2	12
Mobile robot statics and equilibrium.	8	6	2	12
Tracked vehicles and their kinematics.	8	6	2	12
Total:	60	60	12	108

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to describe and analyse the robot system technical solutions.	Revision tests. Exam.
Is able to describe robot motion using vector and matrix calculus.	Course projects.
Is able to develop a plan for manipulator motion if the goal of the motion is set.	Course project Nr.2
Is able to develop mathematical model for robot kinematics.	Revision tests. Exam.

Evaluation criteria of study results

Criterion	%
Revision tests	10
Course project on parallel kinematics	20
Course project on spatial kinematics	30

Exam	40
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.5	2.0	1.0	0.0		*	