GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling of robots and manipulators, PG_00064800		
Field of study	Mechatronics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Mazur	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	4.0	16.0	50

Subject objectives

Expanding knowledge about modeling of robots and manipulators. The perception of robots as amechatronic system. Some specific issues relating to the actors, sensors and control systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] demonstrates knowledge encompassing selected issues in the field of detailed knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Mechatronics	Students have theoretically knowledge related to the issues of mechatronic design and mechatronic systems in the field of robots.	[SW3] Assessment of knowledge contained in written work and projects
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	Students know the available virtual prototyping tools used to design robots.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K7_W02] demonstrates structured and theory supported knowledge encompassing key issues in the field of Mechatronics, enabling modeling and analysis of stationary and non-stationary mechatronic systems, devices, and processes with continuous and discrete operation	Students understand the necessity of using discrete modeling techniques for robot design and operation.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_U02] formulates and tests hypotheses concerning problems od stationary and non-stationary mechatronic systems/processes, as well as simple research problems	Students have knowledge about development trends and the most important new achievements in the field of robots.	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Course content – lecture

LECTURE: 1 Introduction 2 Modern trends in the development of two industrial robots 3 Sensors 4 SignalConditioning 5 Tactile and haptic sensors 6 Methods of localization of mobile robots 7 Effectors 8 Elementsof power supply systems 9 Drive chain elements used in robots 10 Tools for robot programming andsimulation Laboratory: 1 Programming the tasks of a delta robot on the example of ABB IRB360, working with a beltfeeder 2 Programming the tasks of the HC3a collaborative robot using the OnRobot vision system 3Programming the movement of an industrial robot with coupling from a force sensor on the example of theNachi NC04 robot 4. kinematics and dynamics of manipulator movements using the RobotAnalyzer program5. Development of the manipulator's movement path for the implementation of a specific movement task in asimulation using the Nachi MZ04 manipulator available in the RoboDK 6 libraries. Operating the Nachi NC04robot and programming its movement trajectories using the robot controller 7. Preparing the manipulator'smovement path for the purpose of implementing a specific movement task of the ABB IRB360 robot usingthe RobotStudio program and a robot controller. 8. Operating the HCR-3a robot and preparing themanipulator's movement path for the purpose of implementing a specific robot movement task using directlearning</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge and experience in Industrial Robots and Manipulators (I-st level). Knowledge and experience inInformatics (I-st level). Knowledge and experience in Mechatronic design (I-st level).</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Team projects</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Colloquium</td><td>50.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Craig J., J., Wprowadzenie do robotyki. Mechanika i sterowanie, WNT,Warszawa 1993 Honczarenko J., Roboty przemysłowe. Budowa izastosowanie, WNT, Warszawa 2002 Jarzębowska E., Podstawydynamiki mechanizmów i manipulatorów, Oficyna WydawniczaPolitechniki Warszawskiej, Warszawa 1998 Morecki A., Knapczyk J.,Podstawy robotyki. Teoria i elementy manipulatorów i robotów, WNT,Warszawa 1993 Morecki A., Knapczyk J., Kędzior K., Teoriamechanizmów i manipulatorów, WNT, Warszawa 2002 Vidyasagar M.,Spong Mark W.: Dynamika i sterowanie robotów. WNT, Warszawa 1997</td></tr>
<tr><td>Supplementary literature</td><td>Dulęba I., Metody i algorytmy planowania ruchu robotów mobilnych imanipulacyjnych, Akademicka Oficyna Wydawnicza EXIT, Warszawa2001 Giergiel M. J., Hendzel Z., Żylski W.: Modelowanie i sterowaniemobilnych robotów kołowych. PWN, Warszawa 2002 Tchoń K., MazurA., Dulęba I., Hossa R., Muszyński R.: Manipulatory i Roboty Mobilne.Modele, planowanie ruchu, sterowanie. Warszawa: AkademickaOficyna Wydawnicza PLJ 2000</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>What is a sensor?Advantages and disadvantages of digital sensors?Advantages and disadvantages of analog sensors?Discuss conditioning.Haptic systemsRobots development trendsAdvantages and disadvantages of ultrasonic sensors for distance measurementList the location methodsTechniques for measuring distanceMechatronic system of robotsAdvantages and disadvantages of FPGAWhat is High Level Synthesis?Advantages and disadvantages of monolithic architectureAdvantages and disadvantages of distributed architectureRobust programming - fault detection techniquesApplication of real-time systems in robot controlWhat is SLAM?What do we use quaternions for?Discuss Spherical Linear InterpolationApplications of dual quaternionsWhat is ROS?Discuss MoveITDiscuss 2D Navigation in a ROS environmentDiscuss the control of the qaudrocopeterWhat is Zero Moment Point?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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