Syllabus

Descrizione corso

Titolo insegnamento	Industrial Collaborative Robotics
Codice insegnamento	47584
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Ingegneria Industriale Meccanica
Altri Corsi di Studio (mutuati)	
Docenti	prof. Luca Gualtieri, Luca.Gualtieri@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38728
Assistente	
Semestre	Primo semestre
Anno/i di corso	2
CFU	6
Ore didattica frontale	28
Ore di laboratorio	28
Ore di studio individuale	80
Ore di ricevimento previste	22
Sintesi contenuti	The course aims at providing concepts and skills in the industrial collaborative robotics domain. Students will learn: (i) fundamental and advanced concepts of industrial Human-Robot Interaction (HRI); (ii) fundamental and advanced concepts of safety of machinery and risk assessment for industrial traditional and collaborative robots; (iii) fundamental concepts of ergonomics in advanced human-robot interaction; (iv) fundamental and advanced concepts of robot kinematics useful in collaborative applications. Then, they will acquire fundamental knowledge and competences

	on how to program and operate industrial collaborative robots.
Argomenti dell'insegnamento	Main topics for the module "Safety and ergonomics in industrial human-robot interaction": • Fundamentals of industrial Human Robot Interaction (iHRI) • Risk assessment for collaborative applications • Safety measures for industrial HRI • Human factors and ergonomics in advanced iHRI Main topics for the module "Collaborative robotics applications in Industry": • Safety standards and their application/implementation. • Sensors for obstacle/human tracking and for validation/certification of industrial collaborative applications. • Human and skeleton tracking. • Redundant robots and redundancy exploitation in collaborative applications. • (Collaborative) Robot programming – basic and advanced - and motion planning. • Examples of applications and implementation of collaborative tasks.
Parole chiave	Industrial Human-Robot Interaction Collaborative Robotics Safety of Machinery Human Tracking Motion Planning
Prerequisiti	Minimum programming competences.
Insegnamenti propedeutici	
Modalità di insegnamento	Frontal lectures and seminars held by guest researchers and experts; Exercises/Smart Mini Factory lab activities/case study elaboration.
Obbligo di frequenza	Not mandatory
Obiettivi formativi specifici e risultati di apprendimento attesi	Knowledge and understanding Students should acquire the knowledge and the understanding of: Applying knowledge and understanding Making judgements

	Communication skills Ability to learn
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	Formative Assessment: • Exercises in the lecture room (After each unit lecture); • Group work and lab hands-on activities (During the ex/lab hours). Summative Assessment: • Written exam with questions on the theory (1h): 50% of final grade; • Project work encompassing case study and subsequent presentation of the work: 50% of final grade.
Criteri di valutazione	Final evaluation by a single final grade. The final grade is calculated 50% from the results of the written exam and 50% from the results of the project work. Criteria for the evaluation of the written examination are: • completeness and correctness of the answers. Criteria for the evaluation of the project work / case study are: • accuracy and completeness as well as creativity and innovation of the proposed solution and quality of presentation.
Bibliografia obbligatoria	Lecture notes and docs for the exercises/lab sessions will be made available on the online platforms
Bibliografia facoltativa	
Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Ridurre le disuguaglianze, Buona occupazione e crescita economica

Titolo della parte costituente del corso	Safety and Ergonomics in industrial human-robot interaction
Codice insegnamento	47584A
Settore Scientifico-Disciplinare	IIND-05/A
Lingua	Inglese
Docenti	prof. Luca Gualtieri, Luca.Gualtieri@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38728
Assistente	
Semestre	Primo semestre
CFU	3
Docente responsabile	
Ore didattica frontale	16
Ore di laboratorio	12
Ore di studio individuale	40
Ore di ricevimento previste	9
Sintesi contenuti	The course aims at providing concepts and skills in the industrial collaborative robotics domain. Students will learn: (i) fundamental and advanced concepts of industrial Human-Robot Interaction (HRI); (ii) fundamental and advanced concepts of safety of machinery and risk assessment for industrial traditional and collaborative robots; (iii) fundamental concepts of ergonomics in advanced human-robot interaction; (iv) fundamental and advanced concepts of robot kinematics useful in collaborative applications. Then, they will acquire fundamental knowledge and competences on how to program and operate industrial collaborative robots.
Argomenti dell'insegnamento	INTRODUCTION TO INDUSTRIAL ADVANCED HRI - Fundamentals of industrial human-robot interaction; - Applications; - Mechanical risk in iHRI; - Technology analisys; - Case studies and examples;

	SAFETY OF MACHINERY AND RISK ASSESSMENT - Basics of Occupational Health and Safety; - The Machinery Directive and the EHSRs; - Risk assessment for machinery; - Safety by design; - Case studies and examples; SAFETY IN INDUSTRIAL HRI - BASICS - Safety of collaborative robotics applications; - Standards and deliverables for safety in iHRI; - Safety modalities in iHRI according to ISO TS 15066; - The new Machinery Regulation; SAFETY IN INDUSTRIAL HRI - ADVANCED - Modeling human-robot contacts; - Power and Force Limiting; - Design of safe end-effectors; - Measures for risk prevention and mitigation in collaborative applications; Laboratory: - Comparing risk assessment for traditional and collaborative robotics application by using the ISO TR 14121 methodology; - Human-robot contact analysis and computation of Power and Force Limiting parameters; - Design of safe collaborative applications;
Modalità di insegnamento	Frontal lectures, exercises and case study discussion.
Bibliografia obbligatoria	Lecture notes and docs for the ex/lab sessions will be made available on the online platforms
Bibliografia facoltativa	

Modulo del corso

Titolo della parte costituente del corso	Collaborative Robotics Applications in Industry
Codice insegnamento	47584B
Settore Scientifico-Disciplinare	IIND-02/A

Lingua	Inglese
Docenti	prof. Renato Vidoni, renato.vidoni@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/31254 dott. Rabert Rajesh Mallavarapu, RabertRajesh.Mallavarapu2@student.unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/48195
Assistente	
Semestre	Primo semestre
CFU	3
Docente responsabile	
Ore didattica frontale	12
Ore di laboratorio	16
Ore di studio individuale	40
Ore di ricevimento previste	13
Sintesi contenuti	The course aims at providing concepts and skills in the industrial collaborative robotics domain. Students will learn: (i) fundamental and advanced concepts of industrial Human-Robot Interaction (HRI); (ii) fundamental and advanced concepts of safety of machinery and risk assessment for industrial traditional and collaborative robots; (iii) fundamental concepts of ergonomics in advanced human-robot interaction; (iv) fundamental and advanced concepts of robot kinematics useful in collaborative applications. Then, they will acquire fundamental knowledge and competences on how to program and operate industrial collaborative robots.
Argomenti dell'insegnamento	
Modalità di insegnamento	Frontal lectures and seminars held by guest researchers and experts; Exercises/Smart Mini Factory lab activities/case study elaboration.
Bibliografia obbligatoria	Lecture notes and docs for the ex/lab sessions will be made available on the online platforms
Bibliografia facoltativa	