



Master's Programme in

Systems, Control and Robotics

The purpose of the master's programme in Systems, Control and Robotics is to equip students with the skills necessary to analyse, design and control complex technical systems. Such systems are key components in infrastructure and industry, and host a wide array of functions in our daily lives. Therefore, the successful integration of cutting-edge training in engineering with a balanced, holistic systems perspective will remain a crucial area of specialisation for the future.

The master's programme involves team collaborations and projects emphasising the academic and cultural diversity of the field. Students will be able to incorporate and use KTH's strong ties with research and industry leaders for their thesis project in the second year, providing them with excellent career opportunities. The programme starts with man-

datory courses that covers systematic methods for building mathematical models of technical systems from basic physical relations and measured data, and theory and methodology of science. The programme continues with courses given in one of the four tracks chosen by the student.

PROGRAMME TRACKS

Robotics and autonomous systems: This track is intended for students that are interested in autonomous systems. This track has a somewhat broader scope and also looks, for example, at sensing and perception in addition to control.

Networked control systems: The track is intended for students who are interested in future industrial or academic careers within the area of networked control systems. Examples of these systems include, among others, autonomous agents and vehicles, smart electricity grids, smart buildings and factories, and communication networks.

Systems and control theory: This track provides a strong theoretical basis for a future industrial or academic career in complex system design and analysis.

Electric energy systems: This track is intended for students who are interested in systems and control with applications to electric power systems and electrical machines.

In addition to courses associated with the tracks, there are also a large number of elective courses. Finally, each student should take one or two non-technical courses. A small seminar-based course discussing issues related to being an engineer in systems and control runs over the two years.

MASTER'S DEGREE PROJECT

All students carry out a degree project, typically during the second half of the second year, upon completion of the necessary programme credits. The project may involve work in a relevant industry or in a department at KTH, and may be combined with course work. For students who wish to pursue a career in research, the thesis project offers an excellent opportunity to develop contacts and the skills necessary

to work within a research group; and for those wishing to go into industry, it serves as an important introduction and practical foundation for a career with a prospective employer.

Omid Khorsand: A Decentralized Stabilization Scheme for Large-scale Interconnected Systems

Meng Gou: Quantized Cooperative Control
Omid Aghazadeh: Object Segmentation using Spatial and Spatio-Temporal Features

Florian Fiebig: Memory Consolidation through Reinstatement in a Connectionist Model of Hippocampus and Neocortex

Diogo Almeida: Event-Triggered Attitude Stabilization of a Quadcopter

CAREER

A two-year master's degree in Systems, Control and Robotics rests on a core set of courses in systems and control and related subjects, and provides the opportunity to utilise a unique cross-section of courses from different disciplines – integrating, for example, Computer Science and Control Theory – in order to create a comprehensive education. As systems and control engineers require extensive training in the design and analysis of complex technical systems, this master's programme provides a strong foundation in both theory and practice. From advancements in health care and the vehicle industry to providing a variety of important functions in all forms of manufacturing, a large variety of different system examples allow engineering students to combine several educational areas in new, innovative ways.

COURSES

- Mandatory courses: EL2820, AK2036, EL2520, EL2220, DD2410
- Select one or two non-technical courses
- Select at least one project course from the

CONTACT

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- study area
- Requirements from one track
- Complement with recommended courses up to 120 credits
- Compulsory and conditionally elective courses from one track are recommended on all other tracks.

A course can only be listed once below and is listed only as compulsory if it is compulsory on one track and only conditionally elective on another. Please use the course list for each separate track for a complete account of the conditionally elective courses.

		YEAR	CREDITS	1	2	3	4
MANDATORY: ALL TRACKS							
AK2036	Theory and Methodology of Science with Applications	1/2	7.5	x			
EL2220	The Sustainable ... Engineer	1/2	3.0	x	x	x	x
DD2410	Introduction to Robotics	1	7.5	x			
EL2820	Modelling of Dynamical Systems	1	7.5	x			
EL2520	Control Theory and Practice, Advanced Course	1	7.5				x
RECOMMENDED: NON-TECHNICAL							
EH2720	Management of Projects	1	7.5	7.5			
LS2429	Technical Communication in Eng.	1	7.5	7.5			
ME1003	Industrial Management	1	6.0	6.0			
LS1464	Rhetoric - the Art of Persuasion	1	7.5	4.0	3.5		
EH2030	Business Development and Quality Management	1	7.5		7.5		
LS1419	English for Employment	1	7.5		7.5		
LS2439	English for Writing and Presenting a Degree Project in Science	1	7.5		7.5		
ME2089	Leadership in Cross-Cultural and Industrial Contexts	1	6.0		6.0		
DH1620	Human-Computer Interaction, Introductory Course	1	6.0			3.0	3.0
LS2449	Spanish B2 for Engineers	2	7.5			4.0	3.5
ME1003	Industrial Management	2	6.0	6.0			
LS1419	English for Employment	2	7.5		7.5		
LS2439	English for Writing and Presenting a Degree Project in Science and Engineering	2		7.5		7.5	
ME2089	Leadership in Cross-Cultural and Industrial Contexts	2	6.0		6.0		
LS1464	Rhetoric - the Art of Persuasion	2	7.5	4.0	3.5		
EH2030	Business Development and Quality Management	2	7.5		7.5		
PROJECT COURSE							
DD2425	Robotics and Autonomous Systems	1/2	9.0	3.5	x		
EL2425	Automatic Control, Project Course, Smaller Course	1/2	7.5		x		
EP2520	Building Networked Systems Security	1/2	7.5			x	
DD2438	Artificial Intelligence and Multi Agent Systems	1/2	15.0			x	x
SD2231	Applied Vehicle Dynamics Control	1/2	7.5				x
OTHERS							
EQ1220	Signal Theory	1	7.5	7.5			
MF2030	Mechatronics basic Course	1	6.0	6.0			
EL2222	Systems and Control in Practice	1	1.5	0.5	0.5	0.3	0.2
EL1010	Automatic Control, General Course	1	6.0		6.0		

		YEAR	CREDITS	1	2	3	4
MANDATORY: ALL TRACKS							
DD2420	Probabilistic Graphical Models	1	7.5			7.5	
DD2424	Deep Learning in Data Science	1	7.5				7.5
SF1861	Optimization	1	6.0				6.0
IL2206	Embedded Systems	1/2	7.5	x			
MF2043	Robust Mechatronics	1/2	6.0	x			
SF2940	Probability Theory	1/2	7.5	x			
MF2007	Dynamics and Motion Control	1/2	9.0		x		
SF1811	Optimization	1/2	6.0		x		
EQ2310	Digital Communications	1/2	9.0		x	x	
EH2745	Computer Applications in Power Systems	1/2	4.5				x
SF2943	Time Series Analysis	1/2	7.5				x
SF2568	Parallel Computations for Large- Scale Problems	1/2	7.5			3.0	4.5
EQ2321	Speech and Audio Processing	1/2	7.5			x	
EQ2871	Cyber-Physical Networking	1/2	7.5			7.5	
II2302	Sensor Based Systems	1/2	7.5			x	
IL2212	Embedded Software	1/2	7.5			7.5	
SF2812	Applied Linear Optimization	1/2	7.5			7.5	
SF2842	Geometric Control Theory	1/2	7.5			7.5	
SF2832	Mathematical Systems Theory	1/2	7.5		x		
EG2210	Electricity Market Analysis	1/2	7.5			x	
EL2450	Hybrid and Embedded Control Systems	1/2	7.5			x	
DT2140	Multimodal Interaction and Interfaces	1/2	7.5		x		
SF1691	Complex Analysis Replaces SF1628	2	7.5				7.5
DD2401	Neuroscience	2	7.5				7.5
DD2476	Search Engines and Information Retrieval Systems	2	9.0			6.0	3.0
SF2852	Optimal Control Theory	2	7.5	7.5			
DD1385	Software Engineering	2	6.0	2.0	4.0		
EQ2401	Adaptive Signal Processing	2	7.5			7.5	
DD1388	Program System Construction Using C++ Replaces DD1387	2	7.5			4.0	3.5
DD2352	Algorithms and Complexity	2	7.5			4.5	3.0
DD2459	Software Reliability	2	7.5			7.5	
DD2435	Mathematical Modelling of Biological Systems	2	9.0	6.0	3.0		
DD2464	Bigger Advanced, Individual Course in Computer Science	2	9.0	4.5	4.5		
DD2447	Statistical Methods in Applied Computer Science	2	6.0		6.0		
EL2805	Reinforcement Learning (Replaces EL2800)	2	7.5		7.5		
TRACK: ELECTRICAL ENERGY SYSTEMS							
MANDATORY							
EG2100	Power System Analysis	1	6.0	x	x		
EL2450	Hybrid and Embedded Control Systems	1	7.5			x	

		YEAR	CREDITS	1	2	3	4
CONDITIONALLY ELECTIVE							
EG2110	Power System Stability and Con.	1/2	7.5			x	
EH2741	Communication and Control in Electric Power Systems	1/2	6.0			x	
EH2745	Computer Applications in Power Sys.	1/2	4.5				x
EJ2201	Electrical Machines and Drives	1/2	6.0	x	x		
EJ2301	Power Electronics	1/2	6.0	x	x		
EK2350	Microsystem Technology	1/2	7.5				x
EK2360	Hands-On Microelectromechanical Systems Engineering	1/2	7.5		x		
EL2425	Automatic Control, Project Course, Smaller Course	1/2	7.5		x		
EL2620	Nonlinear Control	1/2	7.5		x		
EL2700	Model Predictive Control	1/2	7.5	x			
IS1200	Computer Hardware Engineering	1/2	7.5			x	
TRACK: NETWORKED CONTROL SYSTEMS							
MANDATORY							
EL2450	Hybrid and Embedded Control Systems	1	7.5			x	
EL2745	Principles of Wireless Sensor Networks	2	7.5	x			
CONDITIONALLY ELECTIVE							
DD2424	Deep Learning in Data Science	1	7.5				x
DD2421	Machine Learning	1/2	7.5			x	
EL2320	Applied Estimation	1/2	7.5		x		
EL2425	Automatic Control, Project Course, Smaller Course	1/2	7.5		x		
EL2620	Nonlinear Control	1/2	7.5		x		
EL2700	Model Predictive Control	1/2	7.5	x			
EL2805	Reinforcement Learning	1/2	7.5		x		
EP2200	Queuing Theory and Teletraffic Systems	1/2	7.5			x	
EP2500	Networked Systems Security	1/2	7.5		x		
MF2007	Dynamics and Motion Control	1/2	9.0		x		
MF2043	Robust Mechatronics	1/2	6.0	x			
MF2044	Embedded Systems for Mechatronics, II	2	6.0				
SF2852	Optimal Control Theory	2	7.5	x			
TRACK, ROBOTICS AND AUTONOMOUS SYSTEMS							
MANDATORY							
DD2423	Image Analysis and Computer Vision	1	7.5		x		
EL2320	Applied Estimation	1	7.5		x		
CONDITIONALLY ELECTIVE							
DD2380	Artificial Intelligence	1/2	6.0			x	
DD2411	Research project in Robotics, Perception and Learning	1	15.0			x	x

		YEAR	CREDITS	1	2	3	4
DD2419	Project Course in Robotics and Autonomous Systems	1	9.0			x	x
DD2421	Machine Learning	1/2	7.5			x	
DD2424	Deep Learning in Data Science	1	7.5				x
DD2425	Robotics and Autonomous Systems	1/2	9.0	x	x		
DD2429	Computational Photography	1/2	6.0	x			
DD2434	Machine Learning, Adv. Course	1/2	7.5		x		
DD2437	Artificial Neural Networks and Deep Architectures	1/2	7.5			x	
EL2425	Automatic Control, Project Course	1/2	7.5		x		
EL2450	Hybrid and Embedded Control Systems	1/2	7.5			x	
EL2620	Nonlinear Control	1/2	7.5		x		
EL2700	Model Predictive Control	1/2	7.5	x			
EL2805	Reinforcement Learning	1/2	7.5		x		
EQ2300	Digital Signal Processing	1/2	7.5		x		
EQ2321	Speech and Audio Processing	1/2	7.5			x	
MF2007	Dynamics and Motion Control	1/2	9.0		x		

TRACK: SYSTEMS AND CONTROL THEORY (SCTY)

MANDATORY

EL2700	Model Predictive Control	1	7.5	x			
EL2620	Nonlinear Control	1	7.5		x		

CONDITIONALLY ELECTIVE

EL2425	Automatic Control, Project Course, Smaller Course	1/2	7.5		x		
EL2450	Hybrid and Embedded Control Systems	1/2	7.5			x	
EL2620	Nonlinear Control	2	7.5		x		
EL2700	Model Predictive Control	2	7.5	x			
EL2805	Reinforcement Learning	1/2	7.5		x		
EQ2300	Digital Signal Processing	1/2	7.5		x		
EQ2401	Adaptive Signal Processing	1/2	7.5			x	
EQ2801	Optimal Filtering	2	7.5	x			
SF1691	Complex Analysis	1/2	7.5				x
SF2832	Mathematical Systems Theory	1/2	7.5		x		
SF2842	Geometric Control Theory	1/2	7.5			x	
SF2852	Optimal Control Theory	2	7.5	x			
EH2745	Computer Applications in Power Systems	1/2	4.5				x
EJ2201	Electrical Machines and Drives	1/2	6.0	x	x		
EJ2301	Power Electronics	1/2	6.0	x	x		
EK2350	Microsystem Technology	1/2	7.5				x
EK2360	Hands-On Microelectromechanical Systems Engineering	1/2	7.5		x		
EL2425	Automatic Control, Project Course	1/2	7.5		x		
EL2620	Nonlinear Control	1/2	7.5		x		
EL2700	Model Predictive Control	1/2	7.5	x			
IS1200	Computer Hardware Engineering	1/2	7.5			x	