Industrial drives and electric vehicles - course description

General information

Course name	Industrial drives and electric vehicles
Course ID	06.2-WE-AutD-IDaEV-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics / Computer Control Systems
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2020/2021

Course information

Semester	2
ECTS credits to win	2
Course type	optional
Teaching language	english
Author of syllabus	• dr hab. inż. Marcin Jarnut, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	15	1	-	-	Credit with grade
Laboratory	15	1	-	-	Credit with grade

Aim of the course

To familiarize students with modern power electronics drives used in typical industrial applications and electrical vehicles,

Shaping basic skills in the selection of drives type and parameters for industrial application and for electrical vehicles.

Prerequisites

Sensorics and industrial measurements, Automation of industrial processes

Scope

Construction and control of drives used in industrial equipment and motor vehicles. DC drives: commutator with electromagnetic excitation, commutator with permanent magnet excitation. Three-phase AC drives: asynchronous squirrel-cage, synchronous with trapezoidal shape of the electromotive force (so-called BrushLess DC brushless motors), synchronous with the sinusoidal shape of the electromotive force (Permanet Magnet Synchronous Motor), switching reluctance synchronous (Switching Reluctance Motor).

Pneumatic and hydraulic drives. Construction and operation of basic pneumatic elements. Examples of typical pneumatic drives. Basics of hydraulic drives. Hydraulic servomechanisms.

The specificity of industrial equipment drives. Mechanical characteristics of working machines and selection of drives: machine tools, cranes, mobile machines, forming devices, winding machines, cam machines, etc. Monitoring systems controlling drive systems.

Electromechanical systems of vehicles. Electric drives of vehicles. Hybrid propulsion systems. Structure of the transmission systems. Electric steering. Electrohydraulic and electromechanical brakes. Fuel cells. Properties and distribution of batteries (mechanical, electrochemical, hydroaccumulators, ultracapacitors). Electric vehicle charging concepts.

Teaching methods

Lecture: problem lecture, conventional lecture

Laboratory: practical classes, laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Is able to classify electric drives and select the appropriate drive system for the specific requirements of industrial equipment and electrical vehicles.		• an evaluation test • an ongoing monitoring during classes	• Lecture
Is aware of the importance of electric drives for the development of technology.		• an evaluation test • an oral response	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Is able to use the basic characteristics of electrical machines and mechanical characteristics of working machines in the selection of drives for industrial devices and electrical vehicles.		• an evaluation test • an ongoing monitoring during classes	• Lecture • Laboratory
He can choose the right parameters of converter drives to increase their energy efficiency.		• an evaluation test • an oral response	• Lecture • Laboratory

Assignment conditions

Lecture - the condition of passing is obtaining positive grades from written or oral tests carried out at least once in a semester.

Laboratory - the condition of passing is obtaining positive grades from all laboratory exercises, planned to be implemented under the laboratory program.

Components of the final grade = lecture: 60% + laboratory: 40%

Recommended reading

1. Boldea, S.A. Nasar, Electric Drives, CRC Press, 1999.
2. Ronkowski M., Maszyny elektryczne wokół nas, WPG 2011, http://pbc.gda.pl/Content/16401/659-Ronkowski.pdf.
3. H. Tunia, M. P. Kaźmierkowski, Automatyka napędu przekształtnikowego, PWN, 1987.
4. T. Orłowska-Kowalska, Bezczujnikowe układy napędowe z silnikami indukcyjnymi, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003.
5. M. P. Kaźmierkowski, F. Blaabjerg, R. Krishnan, Control in Power Electronics, Selected Problems, Elsevier, 2002. 5. Z. Grunwald, Napęd elektryczny, WNT, 1987.

Further reading

1. T. R. Crompton, Battery Reference Book, Newnes, Oxford, 2003.
2. Szejnach W., Napęd i sterowanie pneumatyczne, WNT 2005.

Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 04-05-2020 14:36)