COURSE DESCRIPTION CARD - SYLLABUS

Course name

Vehicle dynamics control systems

Course

Field of study

Construction and operation of means of transport

Year/Semester

2/3

Area of study (specialization)

Motor vehicles

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Knowledge:The student has knowledge of vehicle dynamics fundamentals and vehicle dynamics simulation methods. The student has knowledge of fundamentals of control theory.

Skills: The student Is able use the languages: native and international at a level sufficient to enable understanding of technical texts. Is able to obtain information from the literature, internet, databases and other sources. Can integrate the information to interpret and learn from them, create and justify opinions. The student is able to use learned mathematical and physical theories to build and analyze of simple mathematical models of vehicle dynamics.

Social competencies: Understands the need and knows the possibilities of lifelong learning..

Course objective

This course is designed to provide the student with knowledge of physical principles of processes control in motor vehicles. The second objective of the course is to learn state of the art in automotive control systems and future trends. Students should know a typical construction of common automotive control systems and principles of their working.

Course-related learning outcomes

Knowledge

1. Has knowledge of fundamentals of control theory

2. Has knowledge of physical fundamentals of vehicle dynamics processes controlled by commonly used mechatronic vehicle control systems

3. Has knowledge of basic methods of designing and testing control systems

Skills

1. Is able to analyze of operation of fundamental vehicle dynamics control systems used in modern cars with use of computer simulation tools

2. Is able to judge role and importance of particular elements of technical solutions of control systems used in modern cars to diagnose their operation

3. Is able to properly evaluate capabilities and limitation of fundamental control systems used in cars (especially concerning active safety systems)

Social competences

1. Is aware of the importance of usage of mechatronic control systems in modern vehicles

2. Is aware of the importance of design process of control system and the importance of realization of control algorithms for operation effectiveness of particular vehicle subsystems

3. Is aware of necessity of the possession of reliable and detailed knowledge of controlled processes for obtaining desired control goals

4. Is aware of the importance of basing on knowledge of various science and technology disciplines in designing of modern vehicles, causing that they are multidisciplinary products

5. Is aware of capabilities and limitation of control systems used in cars

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written test, which is based on answers related to the selection of given answers and open questions. Credits will be given after achieving at least 50% of points. Answers are scores from 0 to 1 point.

Programme content

History of development, state of the art, and development perspectives of active safety systems.

Structure, configuration and principles of operation of particular vehicle dynamics control systems. Various types of sensors of vehicle dynamics and their principles of operation.

ABS system - physical principles of operation, ABS system BOSCH ABS 2S, 2E, ABS system BOSCH ABS 5 and subsequent systems, ABS systems of Teves (Continental Teves) - MKII, MKIV and subsequent systems.

ABS systems of commercial vehicles with pneumatic braking systems (WABCO, KNORR)

Traction control systems - TCS (ASR, ASC+T and other).

Stability control systems (ESP) - idea of functioning and control algorithms, sensors necessary to ESP operation, structure and design of electro-hydraulic modulator.

Electronic brake force distribution and brake assist systems (EBD i BA).

Electro-hydraulic brakes (EHB - example: Sensotronic Brake Control),

Electro-mechanical brakes.

Adaptive Cruise Control systems.

Gear shifting control systems of automatic and automated gearboxes - conventional hydraulic control systems, electro-hydraulic and electro-mechanical control systems.

Suspension control systems - goals, concepts and algorithms, existing solutions, adaptive, semi-active and active suspensions.

Designing of control systems - hardware and software tools , hardware in the loop simulation (HIL)

Teaching methods

1. Lecture with a multimedia presentation - a combination of an information and problem lecture;

2. Laboratory exercises with the use of Matlab / Simulink systems, dSpace and laboratory stands of varoious vehicle control systems (ABS, semiactive shock absorber, auttoatic transmission)

Bibliography

Basic

1. Reński A.: Bezpieczeństwo czynne samochodu. Zawieszenia oraz układy hamulcowe i kierownicze. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011

2. Reif, K.: Automotive Mechatronics Automotive Networking, Driving Stability Systems, Electronics, Springer 2015

Additional

1. Bosch Automotive Handbook ?8th edition, Bentley Publishers, 2010

2. Rajamani R.: Vehicle Dynamics and Control, Springer 2012

3. Savaresi S., Poussot-Vassal Ch.,Spelta C. Sename O., Dugard L. :Semi-Active Suspension Control Design for Vehicles, Butterworth-Heinemann, 2010

4. Ślaski G.: Studium projektowania zawieszeń samochodowych o zmiennym tłumieniu, Wydawnictwo Politechniki Poznańskiej, Rozprawy. Nr 481. ISSN 0551-6528, Poznań 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	82	3,0
Classes requiring direct contact with the teacher	47	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	35	1,0

[1] delete or add other activities as appropriate