Power electronics systems - opis przedmiotu

Informacje ogólne

Nazwa przedmiotu	Power electronics systems
Kod przedmiotu	06.2-WE-AutP-PES-Er
Wydział	Wydział Informatyki, Elektrotechniki i Automatyki
Kierunek	Automatyka i robotyka
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus pierwszego stopnia
Semestr rozpoczęcia	semestr zimowy 2022/2023

Informacje o przedmiocie

Semestr	5
Liczba punktów ECTS do zdobycia	3
Typ przedmiotu	obieralny
Język nauczania	angielski
Sylabus opracował	• dr hab. inż. Zbigniew Fedyczak, prof. UZ

Formy zajęć

Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	15	1	-	-	Zaliczenie na ocenę
Laboratorium	30	2	-	-	Zaliczenie na ocenę

Cel przedmiotu

Familiarize students with the modeling and analysis of the basic properties of the power converters AC / DC, DC / DC, AC / AC and DC / AC.

Formation among students understand the phenomena occurring in the transformation of electrical energy, in particular, the causes of deteriorating the quality of the conversion.

Shaping the basic skills of selection and parameter settings when using conventional control strategies of power converters.

Wymagania wstępne

Mathematical analysis, Linear algebra, Electrical engineering principles, Circuit theory, Principles of power electronics.

Zakres tematyczny

Introduction. General description (outline) of the preceded course deals with Fundamentals of power electronics (basic power electronics semiconductor devices, basic power electronic converters, standards and conversion quality evaluation, basic control techniques, application field).

AC/DC and AC/AC with phase-angle control. Topologies review, operation description and properties of non-controlled and controlled (thyristorized) six- and multipulse rectifiers, three-phase AC choppers. Application Examples of such converters. Conversion quality of the AC/DC and AC/AC converters using phase-angle control. Influence of such converters on a voltage supplying source (displacement factor, deformation factor and power factor).

PWM DC/DC converters II. Operation descriptions and properties of the DC/DC converters with ideal switch circuit models: non-isolated higher level (types Ćuk, ZETA), isolated (types flyback and forward). Application Examples of such converters.

PWM DC/AC converters II. Topologies, operation descriptions and properties of single- and threephase voltage source and current source inverters (VSI, CSI) with sinus PWM (SPWM) control. PWM control techniques review. Properties of the VSI with space vector PWM (SVPWM) control. PWM AC/DC converters. Topologies, operation description and properties of single- and three-phase rectifiers with sinusoidal input current as well as buck and boost type. Suppliers with power factor correction (PFC). The impulse stabilizators control techniques in the suppliers with unity power factor. Integrated monolithic control circuit in the impulse stabilizators.

Indirect PWM AC/AC converters. Topologies, operation description and properties of PWM AC/DC/AC converters (frequency converters). Output and input current shaping methods in PWM AC/DC/AC converters. Application Examples of the AC/AC frequency converters.

Conversion quality of the circuits with PWM AC/DC and AC/AC converters. Influence of such converters on supplying source (displacement factor, deformation factor and power factor). Future trends of the power electronic circuits (general description).

A new semiconductor power electronic switches and intelligent power modul. Conversion quality improvement as well as new application areas of the power electronic converters.

Metody kształcenia

Lecture, laboratory exercises, project.

Efekty uczenia się i metody weryfikacji osiągania efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
Can indicate basic problems related to the application of power electronic systems		• bieżąca kontrola na zajęciach • kolokwium • projekt	
Has knowledge on peripheral and mathematical models of basic AC/DC, DC/DC, AC/AC and DC/AC power electronic converters		• bieżąca kontrola na zajęciach • kolokwium • projekt	
Can analytically demonstrate basic features of selected power electronic converters		• bieżąca kontrola na zajęciach • kolokwium • projekt	
Understands the need for application of advanced control strategy for power electronic converters		• bieżąca kontrola na zajęciach • kolokwium • projekt	

Warunki zaliczenia

Lecture – obtaining a positive Grade in written or oral Exam.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final Grade: lecture 60% + laboratory 40%.

Literatura podstawowa

1. Mohan N., Power Electronics: Converters, Application and Design, John Wiley & Sons, 1998.

2. Trzynadlowski A., Introduction to modern power electronics, John Wiley & Sons, 1998.

3. Erickson R., W., Maksimowić D.: Fundamentals of power electronics. Kluver Academic Publishers, 1999.

4. Holms D., G., Lipo T., A.: Pulse width modulation for power converters. Principles and practice. John Wiley & Sons Inc., 2003.

Literatura uzupełniająca

1. Pirog S., Power electronics, AGH Publishing House, Cracow, 2006 (in Polish).

2. Mikołajuk K., Fundamentals of power electronic circuits analysis, PWN, Warsaw, 1998 (in Polish).

Uwagi

Zmodyfikowane przez dr hab. inż. Zbigniew Fedyczak, prof. UZ (ostatnia modyfikacja: 13-04-2022 23:17)