Advanced systems for power flow control - course description

General information

Course name	Advanced systems for power flow control
Course ID	06.2-WE-ELEKTD-ASforPFC-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2017/2018

Course information

Semester	3
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Grzegorz Benysek

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	30	2	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

To provide fundamental knowledge in subject of power flow control.

Prerequisites

Circuit theory, Fundamentals of electrical power engineering, Power electronics circuits.

Scope

Distributed generation. Power quality in distributed electrical power system. Limitations of the transmission and distributed power lines.
Control of the parameters of the electrical power system. Series, parallel and series-parallel compensation. Power electronics arrangements for compensation.
Electrical power system - stability. Transient and dynamic stability. Methods of improvement of the stability margin. Influence of the series, parallel and series-parallel compensation on transient and dynamic stability.
Conventional FACTS. Knowledge of TCR, TSC, SVC, TCSC, FC. Influence of the above mentioned on system stability.
FACTS on the base of synchronous sources. Knowledge of SSSC, STATCOM, UPFC, IPFC. Influence of the above mentioned on system stability.
Energy storage arrangements. Batteries. Super-capacitors. Compressed air. Fly wheels. Fuel cells. SMES. FACTS with energy storage – influence on voltage conditions and stability.
UPS arrangements. UPS Standby. UPS Line-interactive. Delta conversion UPS.

Methods for identification of the unneeded components. Basic component identification method. Integral methods. Instantaneous power theory. Kalman filters. Neural networks.
DTF.
Power electronics arrangements for power quality improvement. Series and parallel active filters. Hybrid filters. Series-parallel arrangements for power quality improvement – UPQC. UPLC arrangements.

Teaching methods

Lecture, laboratory exercises.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Knows serial and concurrent compensation.		• an evaluation test	• Lecture
Knows theoretical fundamentals of FACTS and UPS systems operation		• an evaluation test	• Lecture
Knows functionality limitation mechanisms of power grids		• an evaluation test	• Lecture
Can indicate the system eliminating the specific constraints of transmission networks		• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory
Can examine the properties of FACTS and UPS systems		• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory

Assignment conditions

Lecture – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
Laboratory – the main condition to get a pass is acquiring sufficient marks for all laboratory exercises as scheduled.

Recommended reading

1. Strzelecki R., Supronowicz H.: Power factor in alternating currents systems and improvement methods, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2000. (in Polish)
2. Hingorani N., Gyugyi L.: Understanding FACTS. Concepts and technology of flexible AC transmission systems, IEEE Press, New York, 2000.
3. Song Y., Johns A.: Flexible AC transmission systems (FACTS), IEE Power and Energy Series 30, TJ International Ltd, Padstow, Cornwall, 1999.
4. Benysek G.: Improvement in the quality of delivery of electrical energy using power electronics systems, Springer-Verlag Ltd, London, 2007.

Further reading

1. Arrillaga J., Watson N., Power system harmonics, John Wiley & Sons, 2003
2. Machowski J. et all., Power system dynamics and stability, John Wiley & Sons, 1997

Notes

Modified by dr hab. inż. Radosław Kłosiński, prof. UZ (last modification: 30-04-2017 12:11)