

DESCRIPTION OF THE COURSES

- Course code: ELR2110
- Course title: SIMULATION AND ANALYSIS OF POWER SYSTEM TRANSIENTS
- Language of the lecturer: english

<i>Course form</i>	<i>Lecture</i>	<i>Classes</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Number of hours/week*</i>	1			1	
<i>Number of hours/semester*</i>	15			15	
<i>Form of the course completion</i>	pass			pass	
<i>ECTS credits</i>	1			1	
<i>Total Student's Workload</i>	30			30	

- Level of the course (basic/advanced):): advanced
- Prerequisites:
completed course: Circuit Theory, Numerical Methods.
- Name, first name and degree of the lecturer/supervisor:
Eugeniusz Rosołowski, Prof., Ph. D., D. Sc.
- Names, first names and degrees of the team's members:
Jan Iżykowski, Ph. D., D. Sc.
Marek Michalik, Ph. D.
Mirosław Łukowicz, Ph. D.
- Year: 5 Semester: 9
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):
The course provides descriptions of digital models used for simulation of electromagnetic transients in complex three-phase electric networks.
- Form of the teaching (traditional/e-learning): traditional
- Course description:
The course consists a lecture and project. Both of these forms deal with the following problems: Modelling of physical systems - basic principles. Numerical oscillation and accuracy of discrete models. Digital models of basic electric elements with lumped and distributed parameters. Models of selected three-phase system elements: lines, transformers, generators. Models of non-linear electric elements: diodes, thyristors, varistors and non-linear inductance. Numerical methods used in EMTP program for linear and non-linear network equation solution. EMTP application to simulation of selected problems with using of basic network elements: transmission line, transformer, generator, instrument transformers. Using of ATPDraw program for preparation of simulation cases. Using of MODELS module for simulation of an auxiliary procedures: measurement, control and protection. Analysis of simulation results: PLOTXY program, EMTP-MATLAB interface. During the laboratory students complete individual tasks aimed at deep familiarization with the specific problems of electromagnetic transients analysis in power systems.

- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
1. Introduction, syllabus of the course, basic definitions. Computer programs for electromagnetic transients simulations - general description.	2
2. Digital models of linear elements (R , L , C) of an electric network.	2
3. Line model with distributed parameters.	2
4. Numerical oscillation and limitations of using the computer tools to simulation of electromagnetic transients.	2
5. Models of non-linear elements. Solution of the network equations with non-linear elements.	2
6. Modelling of relays, relaying algorithms and instrument transformers.	2
7. Modelling of power electronic devices.	2
8. Pass test.	1

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:
- Project – the contents:

During **the project** students complete individual tasks aimed at deep familiarization with the specific problems of electromagnetic transients simulation in power system. In particular, students have to perform transients analysis during faults for the specified network. It is expected that ATP/EMTP program will be used. Simulation cases will be prepared by using of ATPDraw program. For analysis of the obtained results students will use PLOTXY and MATLAB programs.

- Basic literature:

- [1] N. Watson, J. Arrillaga: Power systems electromagnetic transients simulation. The Institution of Electrical Engineers, London 2003.
- [2] H.W. Dommel: Electromagnetic Transients Program. Reference Manual. BPA, Portland, 1986.
- [3] J. D. Glover, M. Sarma: Power system analysis and design, PWS Publishing Company Boston, second edition, 2002.
- [4] W. D. Stevenson: Elements of Power System Analysis (4th Ed.). McGrawHill, New York, 1982.
- [5] J-P. Barret, P. Bornard, B. Meyer: Power system simulation: Chapman and Hall, London 1997.

- Additional literature:

- [1] Alternative Transients Program. Rule Book. K.U. Leuven, EMTP Center, 1987.
- [2] P. Kacejko P., J. Machowski: Faults in power systems, WNT Warszawa 2002 (in polish).
- [3] Materials available at: <http://www.rose.pwr.wroc.pl/>

- Conditions of the course acceptance/creditation:
test pass, project pass.

* - depending on a system of studies