INTRODUCTION

This special issue of the Journal of Energy is dedicated to the selected graduation thesis on Graduate study programme, profile "Electrical Power Engineering" prepared at the **Department for Energy and Power Systems (ZVNE)**, University of Zagreb Faculty of Electrical Engineering and Computing in last five years (2013. to 2017.). In these five years at ZVNE were defended 169 diploma thesis (masters in engineering) and 282 BSc Thesis (bachelors).

The articles were created in wide cooperation between former students and mentors based on graduation thesis prepared by students and showing the main results of the graduation thesis. Table shows besides paper title and authors also graduated engineer thesis (FER2) number; graduation thesis title in English and original title in Croatian; date of defence and mentor(s) of graduated engineer thesis.

Journal of Energy Special issue 2017 presents **16 papers** selected for publication in Journal of Energy after having undergone the peer review process. I would like to thank the authors for their contributions and the reviewers who dedicated their valuable time in selecting and reviewing these papers. We hope this special issue will provide you valuable information of some student's achievements in preparing graduation thesis at Department of Energy and Power Systems, Faculty of Electrical Engineering and Computing.

1 Short introduction of the Master of Science programs of Electrical Engineering and Information Technology and the profile Electrical Power Engineering

1.1 Master of Science programs at FER

Admission to the Master of Science programs at FER is open to persons holding the bachelor degree in electrical engineering and information technology, in computing and in electrical engineering or other related bachelor degree. To follow this program, first cycle study programs at other faculties or universities, in technical and natural sciences or similar fields, are completely or partially sufficient.

1.2 Electrical Engineering and Information Technology study program

Nowadays, it is almost impossible to come across an activity within electrical engineering that is not interconnected with information technology. Thus, these areas have been joined into the second cycle study program of Electrical engineering and information technology. This program enables a student to acquire the competencies to solve difficult engineering problems, to design complex systems, to act as a leader of a team and to conduct research and development in one of five profiles.

Within the study program, a student immediately decides for a profile. One of profile is "**Electrical Power Engineering**".

1.3 Electrical Power Engineering profile

Electrical Power Engineering is a professional and scientific field of electrical engineering and power systems. It studies and promotes areas of power generation,

transmission and distribution of electric energy as well as electric usage and energy management.

By studying power systems engineering, students gain knowledge of fundamentals and applications of electrical power engineering in a wide range of topics: theory of power systems control; optimization methods applied to power systems; energy efficiency methods; reactive power control; electric facilities automation; reliability theory; expert systems; environmental protection; efficient use of energy and energy conservation; economic analysis; disturbances and transient phenomena in power systems; power system protection; transmission and distribution networks network planning; development, stability, availability, reliability and operational safety of electric power system subsystems; mathematical modelling of power plants components and subsystems; deterministic and reliability analysis of operational safety; development modelling and analysis of environmental impact of electric power systems; establishment of open market environment, risk management and electrical energy trading; economy modelling, business and human resources management ,microeconomics, marketing, etc.

Besides education, research is a crucial factor determining the power systems engineering progress with emphasis on the development of new power system technologies.

1.3.1 The graduation thesis

The graduation thesis is a comprehensive and highly independent task where the student has to demonstrate the ability to analyse the given problem from theoretical and practical aspects, devise a solution using the knowledge acquired in multiple courses and literature, implement the solution, write the documentation and instructions for use and/or for further work, to present his or her work in written and oral form. The accent is given on demonstration of ability in all these aspects rather than to force students to pursue some work intensive repetitive activities in order to fully complete a product.

Students are to achieve self confidence in their acquired knowledge, ability to additionally consult the mandatory or supplementary textbooks, consult the advisor with well-structured and prepared questions and, in most cases, devise a practical solution of moderate but representative functionality. Last, but not least, they have to present it in a written form, formally, linguistically and ethically correct, prepared on computer, according to instructions, of the average overall size of 30 single spaced A4 pages, what raises their awareness of importance of this ability. Computer prepared transparencies and a 10 minutes oral presentation both serve to train the students how to present their work to specific audience within a given time frame.

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Table Papers based on selected graduation engineer thesis on profile "Electrical Power Engineering" at the Department for Energy and Power Systems (ZVNE) in last five years (2013.-2017.)

	Paper title	**Authors**	**Graduated Engineer Thesis (FER2) number:**	**Graduation Thesis TITLE (Original *Title in Croatian*) Date of defence**	**Mentor(s)**
1	THE REAL-TIME COORDINATION OF A WIND-HYDRO POWER GENERATION	Jure Konjevod; Slavko Krajcar; Perica Ilak	Graduated Engineer Thesis (FER2) number: 1367	The real-time coordination of a wind-hydro power generation *(Koordinirani rad u stvarnom vremenu vjetrene i hidroelektrane)* *July*. 2016	Slavko Krajcar
2	NONLINEAR MATHEMATICAL MODEL OF HYDROELECTRIC POWER PLANT	Tomislav Baškarad, Igor Kuzle, Sejid Tešnjak	Graduated Engineer Thesis (FER2) number: 1231	Nonlinear mathematical control systems in Hydroelectrical Power Plants *(Nelinearni matematički modeli regulacijskih sustava u hidroelektrani)* July 2017	Sejid Tešnjak
3	CALCULATION OF VOLTAGE DISTRIBUTION ALONG THE TRANSFORMER WINDING USING THE WIDE BAND TRANSFORMER MODEL	Bruno Jurišić; Luka Bučar; Ivo Uglešić	Graduated Engineer Thesis (FER2) number: 1599.	Transformer models for calculation of high frequency transmitted over-voltages *(Model transformatora za proračun prenesenih prenapona visokih frekvencija*) June 2017	Ivo Uglešić
4	POWER SYSTEM NEUTRAL POINT GROUNDING	Ana Drandić; Ante Marušić; Marino Drandić; Juraj Havelka	Graduated Engineer Thesis (FER2) number: 967	Power system neutral point grounding (*Uzemljenje neutralne točke razdjelne mreže*) July 2014	Ante Marušić
5	THE MATHEMATICAL MODEL OF A WIND POWER PLANT AND A GAS POWER PLANT	Matej Krpan; Igor Kuzle	Graduated Engineer Thesis (FER2) number: 1330	The mathematical model of a wind power plant and a gas power plant (*Matematički model vjetroelektrane i plinske elektrane*) September 2016	Igor Kuzle

	Paper title	**Authors**	**Graduated Engineer Thesis (FER2) number:**	**Graduation Thesis TITLE (Original *Title in Croatian*) Date of defence**	**Mentor(s)**
6	COST-BENEFIT ANALYSIS OF SMART GRIDS PROJECTS IMPLEMENTATION	Marijana Pongrašić; Željko Tomšić	Graduated Engineer Thesis (FER2) number: 1017	Economic analysis of benefits and costs of implementing smart systems in electricity transmission and distribution systems (*Ekonomska analiza dobiti i troškova implementaciji naprednih sustava u prijenosu i distribuciji)* July 2014	Željko Tomšić
7	ANALYSIS OF SPENT FUEL POOL LOSS OF COOLANT INVENTORY ACCIDENT PROGRESSION	Josip Đaković, Davor Grgić	Graduated Engineer Thesis (FER2) number: 1552	Mitigation of Spent Fuel Pool Loss of Coolant Inventory Accidents Using Spray Nozzles (*Ograničavanje posljedica akcidenta gubitka hladioca iz bazena za istrošeno gorivo korištenjem sprej mlaznica)* July 2017	Davor Grgić
8	SMV TO COMTRADE DATA CONVERSION	Kristina Pandžić; Ante Marušić	Graduated Engineer Thesis (FER2) number: 965	SMV to COMTRADE data conversion (*Konverzija podataka iz SMV u COMTRADE format*) July 2014.	Ante Marušić
9	COMPARISON OF RESULTS AND CALCULATION SPEEDS OF VARIOUS POWER SYSTEM POWER FLOW METHODS	Marko Pikutić; Goran Grdenić; Marko Delimar	Graduated Engineer Thesis (FER2) number: 1435	Comparison of results and calculation speeds of various power system power flow methods (*Usporedba rješenja i brzine izvođenja različitih metoda za proračun tokova snaga u elektroenergetskim mrežam*a) February 2017	Marko Delimar

	Paper title	**Authors**	**Graduated Engineer Thesis (FER2) number:**	**Graduation Thesis TITLE (Original *Title in Croatian*) Date of defence**	**Mentor(s)**
10	THE ROLE OF PUMPED-HYDRO STORAGE POWER PLANTS AND LARGE PENETRATION OF ELECTRIC CARS TO INCREASE THE FLEXIBILITY OF THE SYSTEM WITH A LARGE SHARE OF RENEWABLE ENERGY SOURCES	Sara Raos; Željko Tomšić; Ivan Rajšl	Graduated Engineer Thesis (FER2) number: 1594	The role of pumped-hydro storage power plants and large penetration of electric cars to increase the flexibility of the system with a large share of renewable energy sources (*Uloga velike penetracije elektroautomobila u povećanju fleksibilnosti sustava s velikim udjelom obnovljivih izvora*) September 2017.	Željko Tomšić; Ivan Rajšl
11	GENERATION SCHEDULING IN POWER SYSTEMS WITH HIGH PENETRATION OF RENEWABLE ENERGY	Ivan Pavić; Tomislav Capuder; Igor Kuzle	Graduated Engineer Thesis (FER2) number: 944	Generation scheduling in power systems with high penetration of renewable energy (*Raspodjela opterećenja na agregate u elektroenergetskom sustavu s velikim udjelom obnovljivih izvora energije*) July 2014	Igor Kuzle
12	TRANSMISSION LINES PROTECTION USING SIPROTEC NUMERICAL RELAYS	Andrea Stošić; Ante Marušić; Juraj Havelka	Graduated Engineer Thesis (FER2) number: 1082	Transmission lines protection using Siprotec numerical relays, (*Zaštita prijenosnih vodova pomoću numeričke zaštite serije Siprotec*) February 2015.	Ante Marušić

	Paper title	**Authors**	**Graduated Engineer Thesis (FER2) number:**	**Graduation Thesis TITLE (Original *Title in Croatian*) Date of defence**	**Mentor(s)**
13	RENEWABLE ENERGY SOURCES AND OTHER ENERGY TECHNOLOGIES AS A MEASURE FOR MITIGATING THE IMPACT OF URBAN HEAT ISLANDS	Goran Grdenić; Željko Tomšić	Graduated Engineer Thesis (FER2) number: 1016	Renewable energy and other energy technologies as a measure for reducing the impact of urban heat islands (*Obnovljivi izvori energije i druge energetske tehnologije kao mjera za smanjivanje utjecaja gradskih toplinskih otoka*) July 2014.	Željko Tomšić
14	FINANCIAL TRANSMISSION AND STORAGE RIGHTS	Mirna Gržanić; Marko Delimar; Tomislav Capuder	Graduated Engineer Thesis (FER2) number: 1324	Financial Transmission and Storage Rights (*Financijska prava u prijenosnoj mreži*) September 2016	Marko Delimar
14	MATHEMATICAL MODEL OF THE NPP KRŠKO PCFV SYSTEM FOR THE RELAP5 COMPUTER CODE	Borna Pošta; Siniša Šadek	Baccalaureus Thesis number: 5025	The RELAP5 Computational Model of the PCFV System for the NPP Krško (*Matematički model PCFV sustava NE Krško za program RELAP5*) July 2017	Siniša Šadek
16	SHORT-TERM POWER SYSTEM HOURLY LOAD FORECASTING USING ARTIFICIAL NEURAL NETWORKS	Ninoslav Holjevac; Catarina Isabel Nunes Soares; Igor Kuzle	Erasmus student Seminar work, Electric Power System Operation and Planning course	Artificial Neural Network Based Short Term Load Forecasting, ac. year 2016/17 summer semester	Igor Kuzle