

2020 21st International Scientific Conference on Electric Power Engineering (EPE 2020)

**Prague, Czech Republic
19 – 21 October 2020**



**IEEE Catalog Number: CFP2073X-POD
ISBN: 978-1-7281-9480-6**

**Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2073X-POD
ISBN (Print-On-Demand):	978-1-7281-9480-6
ISBN (Online):	978-1-7281-9479-0
ISSN:	2376-5623

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

A - Advanced Distribution Systems, Smart Grids, Micro Grids.....	1
Electric vehicle charging loads in residential areas of apartment houses.....	2
Oula Lehtinen, Sami Pitkaniemi, Atte Weckman, Mikael Aikio, Michel Mabano, Matti Lehtonen (Aalto University, Finland)	
Low Voltage Ride Through Characteristics of Grid Forming inverters.....	8
Ziqian Zhang, Robert Schurhuber, Lothar Fickert (Graz University of Technology, Austria), Guochu Chen, Yongming Zhang (Shanghai Dianji University, China)	
Duplex Reactor - Forgotten Element to Reduce Short-Circuit Currents.....	14
Jakub Urbansky, Lubomir Bena (Technical University of Kosice, Slovak Republic), Vladimir Kristof, Marek Hvizdos (Gridman s.r.o., Slovak Republic)	
The impact of a electric vehicle charging on the distribution system.....	18
Maksym Oliinyk, Jaroslav Dzmura, Daniel Pal (Technical University of Kosice, Slovak Republic)	
Concept of Real-Time Communication in Off-Grid System with Vehicle-to-Home Technology.....	23
Vojtech Blazek, Michal Petruzela, Jan Vysocky, Lukas Prokop, Stanisav Misak, David Seidl (VŠB – Technical University of Ostrava, Czech Republic)	
Negative sequence changes calculation for purposes of fault localization.....	29
Vit Krcaľ, David Topolaneck (Brno University of Technology, Czech Republic)	
A Review of the Holonic Architecture for the Smart Grids and the Self-Healing Application.....	35
Mohamed F. Abdel-Fattah, Hannah Kohler, Peter Rotenberger, Leonard Scholer (Reykjavik University, Iceland)	
The impact of reconfiguration on power losses in smart networks.....	41
Daniel Pal, Lubomir Bena, Jakub Urbansky, Maksym Oliinyk (Technical University of Kosice, Slovak Republic)	
Communication and intelligent control in a power grid using open source IoT technology.....	46
Vaclav Muzik, Zdenek Vostracky (University of West Bohemia, Czech Republic)	
Modelling of AC Electric Railway System using PSCAD/EMTDC.....	50
Mohamed S. Elbelkasi, Ebrahim A. Badran, Mansour H. Abdel-Rahman (Mansoura University, Egypt), Mansour H. Abdel-Rahman, Zdenek Muller (Czech Technical University in Prague, Czech Republic)	
Smart Substation Emulation for BPL Evaluation.....	56
Jan Slacik, Petr Mlynek, Petr Musil, Lukas Benes (Brno University of Technology, Czech Republic), Jan Hlavnicka (E.ON Distribuce, a.s., Czech Republic)	
Setup of a local P2P electric energy market based on smart contract blockchain technology.....	60
Igor Perekalskiy, Sergey Kokin, Dmitriy Kupcov (Ural Federal University, Russian Federation)	
Compensation of reactive power in LV network and its impact on reactive power flow through distribution grid.....	64
Viktor Jurak, Zuzana Bukvisova, Jaroslava Orsagova, David Topolaneck, Michal Ptacek (Brno University of Technology, Czech Republic)	
Measurements for effective potential increase in event of high-current earth fault.....	69
Christin Schmoget (E.DIS Netz GmbH, Germany), Lothar Fickert (Graz University of Technology, Austria)	
Overview of communication scenarios for IEC 60870-5-104 substation model.....	75
Petr Musil, Petr Mlynek (Brno University of Technology, Czech Republic)	

B - Electrical Machines, Drives and Power Electronics.....79

A comparative study of synchronverter stability.....80
Lavr Vetoshkin, Zdenek Muller (Czech Technical University in Prague, Czech Republic)

Comparison of power control method for B4 converter connected to unbalanced grid.....86
Petr Simek (Institute of thermomechanics, Czech academy of science, Czech Republic), Viktor Valouch (Czech Technical University in Prague, Czech Republic)

Analysis of Three-Phase Delta-Connected Converter for Compensation of Unsymmetrical Loads.....92
Martin Bejvl, Petr Simek, Viktor Valouch (Institute of thermomechanics, Czech academy of science, Czech Republic), Radim Hauptmann (Elektrotechnika, a.s., Czech Republic)

A supervisory MPC for synchronverter.....97
Lavr Vetoshkin, Zdenek Muller (Czech Technical University in Prague, Czech Republic)

Influence of Deadtime on Si, SiC and GaN Converters.....103
Pavel Skarolek, Jiri Lettl (Czech Technical University in Prague, Czech Republic)

Design of High Efficiency High frequency Gan Converter.....107
Filipp Frolov, Jiri Lettl (Czech Technical University in Prague, Czech Republic)

Overview of Thyristor Module Parameters for fast static VAr Compensation Available on the Market.....111
Miroslav Novak, Pavel Ringelhan, Leos Kukacka (Technical University of Liberec, Czech Republic)

Design of capacitors in SST.....117
Jakub Zednik (Czech Technical University in Prague, Czech Republic)

Optimum Flux Search Control on Induction Motor Drive with Predictive Torque Control.....122
Pavel Karlovsky, Jiri Lettl, Jan Bauer (Czech Technical University in Prague, Czech Republic)

Simulation analysis of switching performance of GaN power transistors in a high-voltage configuration.....127
Richard Zelnik, Michal Pipiska (University of Zilina, Slovak Republic)

Analysis of High-Voltage Converters With Serial Connection Units and with Input Current Correction.....133
Yury Skorokhod, Dmitriy Philin (Transconverter, Russian Federation), Sergey I. Volskiy (Moscow Aviation Institute, Russian Federation)

Power Supply System for Aircraft eith Electric Traction.....138
Nikolay V. Kuznetsov, Marat V. Yuldashev, Remat V. Yuldashev (Saint-Petersburg State University, Russian Federation), Sergey I. Volskiy, Dmitriy A. Sorokin (Moscow Aviation Institute, Russian Federation)

Data Acquisition System for the Modern Induction Motor Drive applications.....143
Daniel Kouril, Jakub Baca, Martin Sobek, Martin Kuchar, Jan Strossa (VŠB – Technical University of Ostrava, Czech Republic)

Induction motor drive with field-oriented control and speed estimation using feedforward neural network.....148
Jakub Baca, Daniel Kouril, Petr Palacky, Jan Strossa (VŠB – Technical University of Ostrava, Czech Republic)

C - Power Systems Reliability and Maintenance, Asset Management.....154

Dynamic stability in large power system.....155
Stefan Korcak (ČEPS, a. s., Czech Republic)

The Use of Probabilistic Approach in Power System Security Analyses.....159
Maksymilian Przygodzki, Pawel Kubek (Politechnika Śląska, Poland), Maksymilian Przygodzki, Pawel Kubek, Rafal Gwozdz (PSE Innowacje Sp. z o.o., Poland)

Optimal Reactive Power Control in a Multi-Machine Thermal Power Plant.....	164
Tarmo Trummal, Guido Andreesen, Jako Kilter (Tallinn University of Technology, Estonia)	

D - High Voltage Technology, Measurements and Diagnostics.....170

Comparison of behavior of electroinsulating oils using thermo-hysteresis dependencies.....	171
Roman Cimbala, Peter Havran, Pavol Bartko (Technical University of Kosice, Slovak Republic)	

Simulation of Impulse Generator Followed by Practical Verification.....	176
Ludek Pelikan, Michal Krbal, Jaroslava Orsagova (Brno University of Technology, Czech Republic)	

Optimal Adjustment of Double Exponential Model Parameters to Reproduce the Laboratory Volt-Time Curve of Lightning Impulse.....	181
Mahdi Pourakbari-Kasmaei, Matti Lehtonen (Aalto University, Finland), Farhan Mahmood (University of Engineering and Technology, Pakistan), Michal Krbal, Ludek Pelikan, Jaroslava Orsagova, Petr Toman (Brno University of Technology, Czech Republic)	

Partial Discharges Pattern Analysis of Various Covered Conductors.....	186
Ondrej Kabot, Jan Fulneczek, Stanislav Misak, Lukas Prokop (VŠB – Technical University of Ostrava, Czech Republic), Jan Vaculik (E.ON Distribuce, a.s., Czech Republic)	

Lightning Incidence on Transmission Overhead Lines.....	191
Pavel Janys, Radek Prochazka (Czech Technical University in Prague, Czech Republic)	

Calibration of Unipolar High Current Impulses for Resistance Spot Welding.....	195
Jan Hlavacek, Martin Knenicky, Karel Draxler (Czech Technical University in Prague, Czech Republic)	

The disturbance of high-voltage apparatus thermal fields and ways of its diagnostics.....	199
Mikhail I. Sukhichev, Vasiliy V. Titkov, Pavel D. Tukeev (Peter the Great St.Petersburg Polytechnic University, Russian Federation), Amangeldy Bekbayev , Yerlan Sarsenbayev (Satbayev University, Republic of Kazakhstan)	

E - Renewable Energy Sources and Storage Devices.....205

Bioenergy Electricity on Internet of Renewable Energy (IoRE) Framework for Sustainable Electricity Grid Integration in the European Union (EU).....	206
Famous O. Igbinovia, Jiri Krupka,Petr Hajek (University of Pardubice, Czech Republic), Famous O. Igbinovia, Zdenek Muller, Josef Tlusty (Czech Technical University in Prague, Czech Republic)	

Validation of PV inverters frequency response using laboratory test platform.....	212
Petr Mastny, Martin Vojtek, Jan Moravek, Michal Vrana, Jan Klusacek (Brno University of Technology, Czech Republic)	

Analysis of PV Roof Installation Potential and Basic Load Diagram Evaluation Base on Cooperation with EV and BESS at Village with 3,000 Residents.....	217
Martin Stefek, Robin Filip, Martin Paar, Tomas Sacha (Brno University of Technology, Czech Republic)	

Electricity Storage in Internet of Renewable Energy (IoRE) Domain for Sustainable Smart Cities.....	223
Famous O. Igbinovia, Jiri Krupka,Petr Hajek (University of Pardubice, Czech Republic), Famous O. Igbinovia, Zdenek Muller, Josef Tlusty (Czech Technical University in Prague, Czech Republic)	

Particular silicon type photovoltaic cells prolonged degradation.....	229
Milan Belik, Lucie Nohacova (University of West Bohemia, Czech Republic)	

Design of High Voltage Battery Topology Based on Experience with Integrated BMS Modules.....235
Jan Moravek, Petr Mastny (Brno University of Technology, Czech Republic), Mateus Paula Ramos Umbelino (Universidade Federal de Goiás, Brazil)

Power Generating Modules Field Testing Concepts for Verification of Compliance with Operational Requirements.....240
Jiri Drapela, Jan Moravek, Michal Vrana, Petr Mastny (Brno University of Technology, Czech Republic)

Comparison of control methods for power stage of battery management systems with 4 cells.....246
Pavol Spanik, Marek Simcak (University of Zilina, Slovak Republic)

Stability and reliability of power system operation due to use of renewable energy resources.....252
Viktor Elistratov, Irina Kudryasheva (Peter the Great St.Petersburg Polytechnic University, Russian Federation)

Active Battery Management System for Home Battery Energy Storage.....258
Jan Zich (University of West Bohemia, Czech Republic), Jan Jandik (EnergyCloud, a.s., Czech Republic)

Demand Responsive Power Flow Controller Providing Resistive Load Perspective Regulation in Cooperation with Small Generation Units.....262
Jan Klusacek, Michal Vrana, Jiri Drapela (Brno University of Technology, Czech Republic)

Potential of Technical Losses Reduction in Low Voltage Feeder Using Small Photovoltaics.....268
Ahmad Alshammari, Martin Cernan, Zdenek Muller (Czech Technical University in Prague, Czech Republic)

F - EMC, Power Quality Measurement and Improvement.....274

Smart Control System based on Power Quality Parameter Short-term Forecasting.....275
Ibrahim Salem Jahan, Stanislav Misak, Vaclav Snasel (VŠB – Technical University of Ostrava, Czech Republic)

Comparison of Electromagnetic Fields around Electric Power Lines.....280
Dusan Medved, Jan Zbojovsky, Marek Pavlik, Iraida Kolcunova, Jakub Urbansky (Technical University of Kosice, Slovak Republic)

Harmonic Factors for Electromagnetic Field Evaluation in Power Systems according to 2013/35/EU.....286
Katrín Friedl, Robert Schurhuber (Graz University of Technology, Austria)

Impact of Cable Impedance on the Harmonic Emission of LED Lamps.....291
Muhammad Naveed Iqbal, Lauri Kutt, Noman Shabbir, Bilal Asad (Tallinn University of Technology, Estonia)

G - FACTS Controllers in Transmission and Distribution Systems.....296

Investigation of a Damaged Filter-Compensation Unit.....297
Stanislav Nowak, Stanislav Kocman (VŠB – Technical University of Ostrava, Czech Republic)

Numerical Environment for Modeling and Analyzing Transients in Static VAR Compensators.....302
Leos Kukacka, Jakub Necasek, Miroslav Novak (Technical University of Liberec, Czech Republic)

H - Electrical Heat in Industrial Technologies and Intelligent Buildings.....308

Intelligent Scheduling of Heat Pump to Minimize the Cost of Electricity.....309
Behzad Lashkari, Yuxiang Chen, Petr Musilek (University of Alberta, Canada), Michal Musilek (University of Hradec Králové, Czech Republic)

Theoretical measurement limits of parameters of commissioned heat pumps.....315
Jan Rimbala, Jan Kyncl (Czech Technical University in Prague, Czech Republic)

The Control System for Heating of Small Buildings with Heat Recovery unit and Heat Pump.....320
Jakub Jirinec, David Rot (University of West Bohemia, Czech Republic)

Primary Energy Reduction Using Small CHP systems324
Jan Votava, Jan Kyncl, Zdenek Muller, Lavr Vetoshkin, Jan Rimbala (Czech Technical University in Prague, Czech Republic)

The possibilities of reducing energy consumption for the preparation of hot water by suitable switching of the heat pump.....330
Jan Rimbala, Jan Kyncl (Czech Technical University in Prague, Czech Republic)

I - Nuclear Energy Research, Utilization and Safety.....334

Validation of the Serpent2 code for the VR-1 reactor core calculation.....335
Ondrej Novak, Jan Frybort (Czech Technical University in Prague, Czech Republic)

Experimental and simulated data at fragment productions in 100 MeV proton-induced reaction on ^{232}Th339
Robert Holomb, Karel Katovsky, Miroslav Zeman (Brno University of Technology, Czech Republic), Robert Holomb, Ivan Haysak (Uzhgorod National University, Ukraine), Jindrich Adam, Radek Vespalec, Jitka Vrzalova (Institute of Nuclear Physics, Czech Academy of Sciences, Czech Republic), Jindrich Adam, Jitka Vrzalova, Miroslav Zeman, Viktor B. Brudanin, Lukas Zavorka, Dimitar V. Karaivanov, Alexander Solnyshkin, D.V. Filosofov, Jurabek Khushvaktov, V.M. Tsupko-Sitnikov (Joint Institute for Nuclear Research, Russian Federation), Dimitar V. Karaivanov (Institute for Nuclear Research and Nuclear Energy, Bulgaria)

Monte Carlo Calculations of Fast Neutron Transport in Chloride Salts.....344
Ondrej Stastny, Dusan Kral, Kamil Stevanka, Karel Katovsky (Brno University of Technology, Czech Republic), Antonin Krasa (Institute for Advanced Nuclear Systems SCK CEN, Belgium)

Validation of results of Brno CHF experimental loop in annular channel.....350
Ladislav Suk, Kamil Stevanka, Taron Petrosyan, Karel Katovsky (Brno University of Technology, Czech Republic)

Measurement of activation products in chloride salts irradiated by spallation neutrons.....356
Dusan Kral, Miroslav Zeman, Jindrich Adam, Karel Katovsky, Josef Svoboda, Ondrej Stastny (Brno University of Technology, Czech Republic), Jitka Vrzalova, Pavel Tichy, Jurabek Khushvaktov, Alexander Solnyshkin (Joint Institute for Nuclear Research, Russian Federation)

Monte Carlo simulation of bremsstrahlung spectra for low energy electron accelerators.....362
Ivan Haysak, Olexandr V. Takhtasiev (Uzhgorod National University, Ukraine), Jurabek Khushvaktov, Alexander Solnyshkin (Joint Institute for Nuclear Research, Russian Federation), Anhelina Tanchak, Robert Holomb, Karel Katovsky (Brno University of Technology, Czech Republic)

Generation of neutrons on Microtron M-10.....366
Vasyl Martyshychkin, Ivan Haysak, Olexander Okynev, Olexey Fradkin (Uzhgorod National University, Ukraine), Karel Katovsky, Robert Holomb, Anhelina Tanchak (Brno University of Technology, Czech Republic)

Comparison of Neutron Flux Density in Carbon Prism filled with NaCl and Air.....372
Kamil Stevanka, Dusan Kral, Ondrej Stastny, Robert Holomb, Karel Katovsky (Brno University of Technology, Czech Republic), Humberto Martins (Federal University of Vicosa, Brazil)

A Comprehensive Review of Developments of Accelerator Driven Subcritical Systems and Future Requirements.....377
Vinod V. Kumar (Rajiv Gandhi University, India), Karel Katovsky (Brno University of Technology, Czech Republic)

XS data preparation for 3D full core calculations.....383
Pavel Suk, Jan Frybort (Czech Technical University in Prague, Czech Republic)

Verification of the MCNP model of Manganese Bath.....388
Jan Rataj, Tomas Bily, Ondrej Huml, Ondrej Novak, Pavel Suk (Czech Technical University in Prague, Czech Republic)

The Training Reactor VR-1 - 30 Years of Operation.....393
Lenka Frybortova, Jan Rataj, Lubomir Sklenka, Jan Frybort, Filip Fejt, Ondrej Novak (Czech Technical University in Prague, Czech Republic)

Assessment of Various Candidate Salts Properties for Molten Salt Reactor Application by MCNP Software.....400
Taron Petrosyan, Elmira Melyan, Karel Katovsky (Brno University of Technology, Czech Republic)

J - Smart Artificial Outdoor and Indoor Lighting Systems.....406

Influence of Angle of Rotation of Luminaires with Asymmetrical Luminous Intensity Distribution Curve on Calculated Photometric Parameters.....407
Marek Mokran, Roman Dubnicka, Dionyz Gasparovsky (Slovak University of Technology in Bratislava, Slovak Republic)

Fence Lighting System in Transmission System Substations - Night Visibility.....413
Jiri Ullman, Tomas Novak, Jan Sebesta (VŠB – Technical University of Ostrava, Czech Republic), Ivo Ullman (ČEPS, a.s., Czech Republic)

Light Trespass in Street LED Lighting Systems.....417
Marek Balsky, Theodor Terrich (Czech Technical University in Prague, Czech Republic)

Photodetectors for cylindrical illuminance sensor.....421
Michal Kozlok, Petr Zak (Czech Technical University in Prague, Czech Republic)

K - New Trends in Electrical Power Transmission, HVDC, WAMPaC.....426

Energy Harvesting and Communication Systems for Power Lines Inspection Robot.....427
Pavel Valenta, Jiri Zahour, Jindrich Krivka, Kamil Kosturik, Jiri Skala, Vjaceslav Georgiev (University of West Bohemia, Czech Republic)

Fault localization method using WAM systems.....431
Zsolt Conka, Vladimir Kohan, Michal Kolcun (Technical University of Kosice, Slovak Republic), Palfi Judith, Imre J. Rudas (Óbuda University, Hungary)

Optimization of electric power system modes by methods of artificial intelligence.....435
Sergey Kokin, Stepan Dmitriev, Murodbek Safaraliev (Ural Federal University, Russian Federation), Nikolay Djagarov (Nikola Vaptzarov Naval Academy, Bulgaria), Uyangasaikhan Bumtsend (School of Technology m Darkhan-Uul aimag, Mongolia), Javod Ahyoev (Tajik Technical University, Tajikistan)

Concept of Smart Automatic Reclosing for Transient Stability Improvement of Large Power Systems.....439
Jakub Slavik, Zanita Eleschova (Slovak University of Technology in Bratislava, Slovak Republic)

The Effect of Temporal Discretization on Dynamic Thermal Line Rating.....444
Tomas Barton, Petr Musilek (University of Alberta, Canada), Michal Musilek (University of Hradec Králové, Czech Republic)

Factors Affecting Transient Stability Simulation Possibilities in PSCAD and MODES.....450
Jan Koudelka, Ivan Gromotovic, Branislav Batora, Petr Toman (Brno University of Technology, Czech Republic)

L - Transient Voltages, Insulation Coordination, Overvoltage Protection.....455

Simulation of earthing switch behavior and its test verification.....456
Jiri Valenta, David Simek, Lukas Dostal, Petr Kloc (Brno University of Technology, Czech Republic), Frantisek Koudelka, Martin Grycz (ABB s.r.o., Czech Republic)

Electrical strength of the oil-paper insulation system at DC and AC voltage.....462
Iraida Kolcunova, Jan Zbojovsky, Marek Pavlik, Bystrik Dolnik, Dusan Medved, Samuel Bucko (Technical University of Kosice, Slovak Republic)

Breakdown Behaviour of Oil-Barrier Insulation at Lightning Impulse Voltage.....466
Rainer Haller, Jaroslav Hornak, Pavel Trnka, Roman Hamar (University of West Bohemia, Czech Republic), Jan Hlavacek (Czech Technical University in Prague, Czech Republic)

A Relation of the Parameters of Grounding Device with the Level of Over-voltage when a Surge Arrester Triggered.....472
Yuri E. Adamyan, Ivan S. Kolodkin, Sergey I. Krivosheev, Sergey G. Magazinov, Vasilij V. Titkov, Konstantin V. Iakushov (Peter the Great St.Petersburg Polytechnic University, Russian Federation)

The features of lightning protection of low-voltage system of Air insulated High Voltage Substation by surge protective device.....476
Anton Kosorukov, Nataliya Kutuzova (JSC, Russian Federation), Pavel D. Tukeev, Svetlana Pashicheva, Vasilij V. Titkov (Peter the Great St.Petersburg Polytechnic University, Russian Federation), Petr Toman (Brno University of Technology, Czech Republic)

M - Power Systems Planning and Development.....482

Turbine Control in Island Operation.....483
Stefan Korcak, Tomas Haba, Karel Maslo (ČEPS, a. s., Czech Republic)

Emergency situations in the transmission grid and opportunities for their prevention through the intraday electricity market.....489
Jakub Srom, Zdenek Muller (Czech Technical University in Prague, Czech Republic)

Clustering of Transmission System Loads Based on Monthly Load Class Energy Consumptions.....494
Madis Leinakse, Jako Kilter (Tallinn University of Technology, Estonia)

The KRG GRID Network Comparison Between Two Different Years 2013 and 2019.....500
Dana Bahram Khudhur, Zdenek Muller (Czech Technical University in Prague, Czech Republic)

Critical Infrastructure and the Possibility of Increasing its Resilience in the Context of the Energy Sector.....505
Martin Cernan, Zdenek Muller, Josef Tlustý, Jiri Halaska (Czech Technical University in Prague, Czech Republic)

Methodology of Electricity Supplying of Critical Infrastructure in Crisis Situations.....510
Martin Cernan, Zdenek Muller, Josef Tlustý, Jiri Halaska (Czech Technical University in Prague, Czech Republic)