



( 1 )

# Ramptime Current -Controlled APF for Harmonic Mitigation, Power Factor Correction and Load Balancing

Mazen Abdel-Salam, Adel Ahmed, Mohamed Abdel-Sater

## Abstract:

This paper presents a simulation for a shunt active power filter aimed at mitigation of harmonics, power factor correction and balancing of unbalanced three-phase system. The system consists of load fed through a six pulse bridge rectifier. The active power filter consists of a three-phase current-controlled voltage source inverter (CC-VSI) with a filter inductance at the ac output and a dc-bus capacitor. The CC-VSI is operated to directly control the ac source current to be sinusoidal and in phase with the ac source voltage. The inverter switching is controlled using ramptime current control being based on the concept of zero average current error (ZACE). The active power filter reference currents are generated using perfect harmonic cancellation (PHC) control method. The proposed filter successfully succeeded in reducing the total harmonic distortion (THD) to less than unity, correcting power factor to unity and balancing of unbalanced currents under sinusoidal and distorted supply voltages. The dynamic performance of the proposed filter is so fast to meet the dynamic load conditions.

## Published In:

Proceedings of the 14th International Middle East Power Systems Conference (MEPCON'10) , , PP.144-150



( 2 )

# Harmonic Mitigation, Maximum Power Point Tracking, and Dynamic Performance of Variable-speed Grid-connected Wind Turbine

Mazen Abdel-Salam; Adel Ahmed; Mohamed Abdel-Sater

## Abstract:

This article presents a method for harmonic mitigation and maximum power point tracking for a variable-speed grid-connected 20-kW wind turbine. The wind energy conversion system consists of a permanent magnet synchronous generator driven by variable-speed 20-kW wind turbine. The output of the permanent magnet synchronous generator is connected to a single-switch three-phase boost rectifier to generate DC voltage, which feeds a current-controlled inverter to interface the system with the electric utility. The single-switch three-phase boost rectifier is an active power factor correction technique to maintain the power factor at the permanent magnet synchronous generator side to nearly unity and mitigate the permanent magnet synchronous generator current harmonics. To mitigate inverter output current and voltage harmonics, an LCL filter has been used. A complete analysis of the harmonic content has been done everywhere in the system. The results show that the proposed maximum power point tracking control strategy succeeded to track the maximum wind power irrespective of the wind speed. This strategy in presence of an LCL filter achieved harmonic mitigation at the permanent magnet synchronous generator and inverter output sides. The dynamic response of the wind energy conversion system is tested under a three-phase fault condition. For comparison purposes, an active power filter is designed and checked against the single-switch three-phase boost rectifier for harmonic mitigation at the permanent magnet synchronous generator side.

## Published In:

Electric Power Components and Systems , Vol.39 , PP. 176-190



( 3 )

# New High Voltage Grain Dual Boost Dc-DC Converter for Photovoltaic Power Systems

Kh. Sayed, M. Abdel-Salam, A. Ahmed and M. Ahmed

## Abstract:

This article presents a new circuit topology of a high-voltage step-up boost DC-DC converter for photovoltaic power systems. The converter boosts the low-output voltage of the solar cell to the required voltage for the load. The proposed circuit has various advantages compared to the conventional boost converters, namely a higher boost rate with low duty cycle, lower voltage stress on components, and higher efficiency. The equations of a dual-boost converter are analyzed, highlighting the advantages of the new DC/DC converter circuit topology. The operation principle is explained using the operating intervals equivalent circuits and operation waveforms. Then, mathematical and theoretical analyses of continuous and discontinuous conduction modes of the converter are presented. Losses and thus efficiency of the proposed converter are calculated using MATLAB (The MathWorks, Natick, Massachusetts, USA). Calculations are used to compare the efficiency of the proposed topology with others available in the literature regarding the benefits of decreasing cost and complexity. A photovoltaic system simulation model is developed using PSIM (Powersim Inc., Woburn, Massachusetts, USA) to validate the proposed converter. The proposed high voltage gain boost converter has been implemented for a 100-W load and tested to verify the principle of operation.

## Keywords:

DC-DC converters, power electronics, power converters

## Published In:

J. Elect. Power Components & Systems , Vol. 40 , pp.711-728



( 4 )

# Mathematical Modeling of Flashover Mechanism due to Deposition of Fire-produced Soot Particles on Suspension Insulators of a HVTL

Emad H. El-Zohri, M. Abdel-Salam, Hamdy M. Shafey, A. Ahmed

## Abstract:

This paper presents a mathematical integrated model that simulates the coupled events causing flashover due to the deposition of soot particles on suspension insulators of high voltage transmission lines (HVTL). The model considers non-steady three-dimensional multi-phase flow of agricultural fire producing the soot particles. In addition, the model describes in detail the mechanism of the soot deposition combined with the developing of the electric field. The model equations are simultaneously solved using an iterative finite-volume numerical technique together with the indirect boundary element and charge simulation methods. The model validity and accuracy are verified through the discussion of the results for a representative case study of a 15 kV cap-and-pin insulator string. The discussion includes a comparison of the present numerical predictions for characteristics of the deposited soot layer, electric field distribution, and characteristics of flashover occurrence, with the available results in the literature.

## Keywords:

Mathematical modeling of agricultural fires; Soot deposition; Fire-induced-flashover

## Published In:

Electric Power Systems Research , ,



( 5 )

## New High Voltage Gain Dual- boost DC-DC Converter for Photovoltaic Power Systems

Khairy Sayed, Mazen Abdel-Salam, Adel Ahmed, Mahmoud Ahmed

### Abstract:

This article presents a new circuit topology of a high-voltage step-up boost DC-DC converter for photovoltaic power systems. The converter boosts the low-output voltage of the solar cell to the required voltage for the load. The proposed circuit has various advantages compared to the conventional boost converters, namely a higher boost rate with low duty cycle, lower voltage stress on components, and higher efficiency. The equations of a dual-boost converter are analyzed, highlighting the advantages of the new DC/DC converter circuit topology. The operation principle is explained using the operating intervals equivalent circuits and operation waveforms. Then, mathematical and theoretical analyses of continuous and discontinuous conduction modes of the converter are presented. Losses and thus efficiency of the proposed converter are calculated using MATLAB (The MathWorks, Natick, Massachusetts, USA). Calculations are used to compare the efficiency of the proposed topology with others available in the literature regarding the benefits of decreasing cost and complexity. A photovoltaic system simulation model is developed using PSIM (Powersim Inc., Woburn, Massachusetts, USA) to validate the proposed converter. The proposed high voltage gain boost converter has been implemented for a 100-W load and tested to verify the principle of operation.

### Published In:

Electric Power Components and Systems, USA, , Vol. 40 , pp. 711-728



( 6 )

## Steady-state Modeling and Control of a Microgrid Supplying Irrigation Load in Toshka Area

Mazen Abdel-Salam, Adel Ahmed, Hamdy Ziedan, Rashad Kamel, Khairy Sayed, Mahmoud Amery and Mohamed Swify

### Abstract:

This paper is aimed at sizing solar-wind-battery standalone microgrid for supplying irrigation and domestic loads in Toshka area, Toshka, Egypt. Not only the MG system components but also the interconnection cables and feeders are sized. Steady-state power flow through the MG system is analysed at varying sun irradiation and wind speed. Modeling of the MG components and their control of system voltages, currents and powers are investigated. Power flows during different MG operation conditions including absence of wind and sun as well as sudden disconnection of the load are studied

### Keywords:

Hybrid Solar-Wind , Irrigation System , Toshka Area , control system , power flow

### Published In:

IECON 2012 - 38th Annual Conference on IEEE Industrial Electronics Society , , 6



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( 7 )

# Design and Implementation of Stand-alone Residential PV System

Mazen Abdel-Salam, Adel Ahmed, Mahmoud Amery, Mohamed Swify, Ahmed El-kousy, Khairy Sayed

## Abstract:

This paper is focused on construction of a stand-alone residential 2-kW centralized PV system to feed different domestic loads at a home including lighting loads, washing machine, TV, refrigerator and computer. The stand-alone residential 2-kW PV system consists of PV generator, storage batteries, charge regulator, inverter, filter and maximum power point tracking control system. The paper in steps includes PV modeling, software development for monitoring storage batteries, development of maximum power point tracking controller, design and implementation of an inverter and use of a filter to improve the inverter output waveform.

## Keywords:

PV system, residential load, inverter, filter

## Published In:

Applied Electrical Engineering and Computing Technologies (AEECT), 2011 IEEE Jordan Conference on , , 6



( 8 )

## Steady-State Modeling and Control of a Microgrid Supplying Irrigation load in Toshka Area", 38th Annual IEEE Industrial Electronics Conf

M. Abdel-Salam, A. Ahmed, H. Ziedan, R. Kamel, Kh. Sayed, M. Amery and M. Swify

### Abstract:

This paper is aimed at sizing solar-wind-battery standalone microgrid for supplying irrigation and domestic loads in Toshka area, Toshka, Egypt. Not only the MG system components but also the interconnection cables and feeders are sized. Steady-state power flow through the MG system is analysed at varying sun irradiation and wind speed. Modeling of the MG components and their control of system voltages, currents and powers are investigated. Power flows during different MG operation conditions including absence of wind and sun as well as sudden disconnection of the load are studied.

### Keywords:

Hybrid Solar-Wind , Irrigation System , Toshka Area , control system , power flow

### Published In:

IECON , , pp. 5673-5678





( 9 )

## -NO<sub>x</sub> Removal Using Dielectric Barrier Discharges in a Wire cylinder Reactor Stressed by High Pulse Voltage

Hassan Wedaa, Mazen Abdel-Salam, Adel Ahmed and Akira Mizuno

### Abstract:

This paper is aimed at investigating the nitrogen oxides (NO<sub>x</sub>=NO+NO<sub>2</sub>) removal using dielectric barrier discharges (DBD) in a wire-cylinder reactor filled with dielectric pellets and stressed by high pulse voltage. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, and use of the dielectric pellets) on the discharge power and NO/ NO<sub>x</sub> removal efficiency have been studied experimentally. Two dielectric materials (α-alumina and glass pellets) were evaluated for their ability to reduce NO<sub>x</sub> using non-thermal plasma. To improve the NO<sub>x</sub> removal efficiency, the output of the plasma reactor was pumped into sodium sulfite (Na<sub>2</sub> SO<sub>3</sub>) solution with different concentrations to absorb NO<sub>2</sub>. It has been found that the discharge power and NO/ NO<sub>x</sub> removal efficiency increase with the increase of the applied peak voltage and frequency. On the other hand, the discharge power is independent of the gas flow rate, while the NO/ NO<sub>x</sub> removal efficiency increases with decreasing gas flow rate. The α-alumina pellets give the best performance for removing both NO and NO<sub>x</sub> when compared with others due to their ability to oxidize NO to NO<sub>2</sub> and absorb the resulting NO<sub>2</sub>. The NO<sub>x</sub> removal efficiency increases with the increase of the concentration of sodium sulfite solution.

### Keywords:

α-alumina pellets , Dielectric barrier discharges , NO removal , ac high voltage , multi-rod DBD reactor , pulse voltage

### Published In:

ICESP (International Conference of Electrostatic Precipitation) , , 9-13 pp.



( 10 )

## Characteristics of Sliding Discharge in a Multi-Rod Reactor

H. Wedaa, M. Abdel-Salam, A. Ahmed, and A. Mizuno

### Abstract:

This paper is aimed at investigating the characteristics of a sliding discharge (SD) including the onset voltage (VO), spark voltage (VS), and current-voltage (I-V) relationship in a multi-rod reactor stressed by sinusoidal AC or pulse voltage. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, and voltage type) on the characteristics of the reactor sliding discharge (VO, VS and I-V relationship) have been studied experimentally. It has been found that the DC onset and spark voltages increase with the increase of the gas flow rate, while the effect of the frequency on them is not pronounced. The onset and spark voltages of the stressed reactor for sinusoidal AC voltage are lower than those obtained under a pulse voltage of the same peak value. Subsequently, the sliding current increases with the increase of the sinusoidal AC high voltage, the frequency, and the negative DC voltage, while, it decreases with the increase of the flow rate. It is observed that stressing the reactor with sinusoidal AC voltage gives higher values of sliding current than those obtained using a pulse at the same peak voltage. Stressing the reactor with sinusoidal AC voltage gives higher values of the NO removal efficiency than those obtained using pulse voltage.

### Published In:

J. Phys. Conf. Series 301, Intern Conf. on Electrostatics, Bangor, Wales, UK , ,



( 11 )

# NO Removal Using Dielectric Barrier Discharges in a Multi-rod Reactor Stressed by AC and Pulsed High Voltages

Hassan Wedaa, Mazen Abdel-Salam, Adel Ahmed and Akira Mizuno

## Abstract:

This paper is aimed at investigating the nitric oxide (NO) removal using dielectric barrier discharges (DBD) in a multi-rod reactor stressed by ac and pulse high voltages. The effects of various parameters (the voltage amplitude, frequency, gas flow rate, use of the  $\alpha$ -alumina pellets and the voltage type) on the discharge power and NO removal rate have been studied experimentally in the multi-rod DBD reactor. When the reactor was filled with  $\alpha$ -alumina pellets, improvement in NO removal rate was observed. The pulse voltage gives higher NO removal rate in comparison with ac voltage at the same energy density. Records of the discharge photograph and the emission intensity have been made at varying voltage amplitude, frequency, and gas flow rate. The records confirm the dependency of the discharge power on these parameters.

## Published In:

IEEE Transactions on Dielectrics and Electrical Insulation Germany , vol-18 , 1743-1751



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( 12 )  
ANALYSIS OF CORONA DISCHARGE IN ELECTROSTATIC  
MOTOR GAPS

Mazen Abdel-Salam, Adel Ahmed, Hamdy Ziedan and Fahd Diab

**Abstract:**

This paper is aimed at calculating corona current-voltage characteristics of a new design of an electrostatic motor with a cylindrical rotor made from aluminium foil and multi stator copper electrodes. The stator electrodes are alternately stressed positively and negatively. The corona currents emitted from positively and negatively-stressed electrodes are calculated being dependent on the applied voltage and motor geometry. The method of calculation is based on simultaneous solution of Poisson's equation, current density equation and continuity equation for current density. This calls at first for calculation of the spatial distribution of electric field within the motor volume using the accurate charge simulation technique. The calculated current-voltage characteristics of the motor agreed reasonably with those measured experimentally for three motors built-in the laboratory.

**Keywords:**

Electrostatic motor, corona-discharge, electric field, corona current.

**Published In:**

Journal of Engineering Sciences, Assiut University, Faculty of Engineering , 41-5 , 1842 - 1856



( 13 )

## A ripple current minimisation based single phase PWM inverter

Khairy Sayed; Mazen Abdel-Salam; Adel Ahmed; Mahmoud Ahmed

### Abstract:

This paper is aimed at improving the output voltage waveform of a single phase PWM inverter. Two approaches is proposed, the first approach is based on selected harmonic elimination (SHE) of order up to 7th harmonic, for minimising harmonic distortion and modulating amplitude of the fundamental component of the output voltage waveform. For the first time, the Levenberg-Marquardt algorithm (LMA) is used for determining the switching angles of the inverter switches. The second approach is based on ripple current minimisation using LMA. A simulation model is developed using PSIM for the inverter to verify the proposed approaches. An experimental system was implemented to demonstrate the effectiveness of the proposed approaches by using PIC16F877 microcontroller. Analysis of the voltage THD as influenced by the amplitude modulation index is made using MATLAB based on the computed switching angles.

### Keywords:

single phase PWM inverters; pulse width modulation; LMA; Levenberg-Marquardt algorithm; switching angles; ripple current minimisation; selected harmonic elimination; output voltage waveform; harmonic distortion; amplitude modulation; simulation; microcontrollers.

### Published In:

Int. J. of Power Electronics , Vol.6, No.3 , PP.201 - 223



( 14 )

# Surface Potential and Resistance of Grounding Grid Systems in Homogeneous Soil

M. ABDEL-SALAM A. AHMED M. NAYEL ABOELSOOD ZIDAN

## Abstract:

This article presents laboratory scale models developed to study the performance of grounding systems in uniform soil. Two parallel grids are investigated and correlated with a same mass grid having the same conductormaterial and extending over the same area at a depth equal to that of the upper grid. The experimental results demonstrate how the potential profiles and ground resistance are influenced by the grounding grid design such as number of meshes, grid depth and spacing between parallel grids. The effectiveness of the two parallel grids is compared with that of the upper grid only. The measured surface potential and ground resistance agreed satisfactorily with the present calculated values

## Keywords:

surface potential, step voltage, ground resistance, scale model, grounding grids

## Published In:

Electric Power Components and Systems , 35 , 1093-1109



( 15 )

## Two-dimensional modelling of dielectric barrier discharges using charge simulation technique-theory against experiment

Hassan Wedaa Mazen Abdel-salam Adel Ahmed Akira Mizuno

### Abstract:

This study is aimed at calculating the discharge onset voltages and power loss of the AC discharge using the charge simulation technique in a wire-cylinder reactor with a dielectric barrier at atmospheric pressure and room temperature. The calculation of the discharge onset voltages is based on the criterion of self-sustained growth of onset streamers and Trichel pulses in positive and negative half cycles, respectively. The emission of ions (space charges) from the wire surface is assumed to take place when the magnitude of the surface charge exceeds the corresponding onset values based on pre-defined discharge onset voltages for both positive and negative half cycles. The space charges are displaced by the prevailing electric field until accumulated on the glass surface. Discharge power loss corresponds to the energy required for the displacements of emitted space charges. The calculated values of the discharge onset voltage and power loss agreed reasonably with those measured experimentally.

### Keywords:

onset voltage, space charges, dielectric barrier discharges, charge simulation method, wire-cylinder DBD reactor

### Published In:

IET Science, Measurement and Technology , Vol. 8, No. 5 , pp. 285-293



( 16 )

# Wavelet Based Analysis for Transmission Line Fault Location

Mazen Abdel-Salam Adel Ahmed Wael Ahmed

## Abstract:

This paper presents wavelet based analysis for transmission line fault location. Faults in power transmission lines cause transients that travel at a speed close to the speed of light and propagate along the line as traveling waves (TWs). Traveling wave theory is utilized in capturing the travel time of the transients along the monitored lines between the fault point and the protective relay. This will help in proposing an accurate fault location technique based on high frequency components of fault current. Time resolution for these components is provided by the wavelet transform. This approach has the advantages of being independent of the fault impedance and fault inception angle. The application of the proposed technique for typical faults is illustrated using transient simulations obtained by MATLAB Simulink program.

## Keywords:

travelling waves, wavelet transform, fault location, MATLAB Simulink.

## Published In:

Innovative Systems Design and Engineering , Vol.4, No. 14 , 145-156





( 17 )

## Modeling and Simulation of Fuel Cell Electric Vehicles

Mazen Abdel-Salam, Adel Ahmed, Ahmed Elnozahy and Ahmad Eid

### Abstract:

Abstract - The objective of this paper is to develop a model for a fuel cell hydrogen vehicle driven by a brushless DC motor. A two leg directly coupled interleaved boost converter is used to power the motor from the fuel cell through a three-phase inverter. The studied system of the fuel-cell vehicle is designed and simulated using the commercial PSIM9 software. Due the presence of power converters, different harmonic components exist in the system, especially in the input voltage/current to the motor. The ripple contents of current and voltage at the fuel cell output and the motor input are estimated. An active power filter is designed in order to reduce the current and voltage harmonics of brushless DC motor. The instantaneous active and reactive current components  $i_d$ - $i_q$  control method is used in this study to lessen the harmonic contents at the input of the Brushless DC motor to the standard values.

### Keywords:

Fuel cell, BLDC motor, Interleaved boost converter, Active power filter and Hybrid vehicles.

### Published In:

15th International Middle East Power Systems Conference (MEPCON'12) , ,



( 18 )

## Analysis of a Corona-Discharge Based Electrostatic Motor

Mazen Abdel-Salam, Adel Ahmed, Hamdy Ziedan and Fahd Diab

### Abstract:

This paper is aimed at proposing a new design of a corona-discharge based electrostatic motor with a cylindrical rotor made from aluminum foil and multi copper strip stator electrodes. The stator electrodes are alternately stressed positively and negatively. The onset voltage of corona discharge is calculated based on the condition of discharge sustenance at stator electrodes. The corona currents emitted from positively and negatively stressed electrodes are calculated being dependent on the applied voltage and motor geometry. This calls at first for calculation of the spatial distribution of electric field within the motor volume using the accurate charge simulation technique. The calculated corona onset voltage and current-voltage characteristics of the motor agreed reasonably with those measured experimentally for three motors built-in the laboratory. The dependency of the motor speed on the applied voltage is reported for the different investigated motors.

### Keywords:

Electrostatic motor, ionic wind, corona-discharge, field mapping, corona current, motor speed

### Published In:

International Journal of Plasma Environmental Science and Technology, Japan , 8-1 , 60-69



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( 19 )

## Assessment of Induced Voltage on a Human Underneath Stressed Overhead Conductors. .

M. Abdel-Salam, A. Ahmed, and Azza Hashem

### Abstract:

NULL

### Keywords:

NULL

### Published In:

International Journal of Plasma Environmental Science & Technology Vol.3 No. 2, 99-106, 2009 , Vol.3 No. 2 , 99-106



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( 20 )

# On The Pitfalls of Charge Simulation Technique in Field Calculations.

M. Abdel-Salam, Azza Hashem and A. Ahmed

## Abstract:

NULL

## Keywords:

NULL

## Published In:

Proceeding of the 41st International Universities Power Engineering Conference, Newcastle, UK, , vol. 1 , 936-940