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International Multi-Conference
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July 20-23 - 2008, Amman, Jordan

Paper reference
SSD08-Plenary-1

Building tomorrow's electrical engineers

Isam Zabalawi
Higher Education Consultant, Jordan

Abstract

Technology has often been cited as the major driving force behind innovation in higher education and for educational reform in a variety of contexts. Modern digital technologies such as computers, telecommunications, and networks are reshaping and eventually revolutionizing both our society and our social and educational institutions. A new society, the knowledge society is thus arising, the elements of which coexisting with the constitutive elements of the industrial and postindustrial society. The most obvious aspect of the new society is the speed of use, application and dissemination of the communication and information technologies, which puts in the shade the fact that there occurs a major transformation of concepts, structures and institutions specific to the previous society. Within the technological context, electrical engineers play a significant role. They develop new design, manufacturing processes and products. They advance and manage communication, transportation, health care devices and energy systems. They address the environmental issues and the make technology work. The electrical engineering activities generate a remarkable potential for the private and the public sectors to develop the national wealth and strength. The chairman of the American National Academy of Engineering noted that "the nation the best engineering talent is in possession of the core ingredient of comparative economic and industrial advantage".

Index-Terms: Electrical Engineering.

Biography of the speaker: Dr. Zabalawi was born in Amman, Jordan (1950). He received his B.Sc. honors with distinction in electrical engineering (communications)in 1974 from Cairo University (Egypt), and his M.Sc. with distinction in Microwave Communication Engineering form Leeds University (England) in 1976, and his Ph.D. in Electrical and Electronics Engineering from Leeds University (England) in 1979. He was granted The Leeds University award for graduate studies for three years 1976-1979.

Dr. Zabalawi is specialized in analog and digital signal processing and communication techniques. His interests include: communication industry, information technology, and technology transfer and higher education development.

Dr. Zabalawi served as the founding president for the newly established private university in Syria the International University or Science and Technology (IUST) from May 2005 until May 2007.

Dr. Zabalawi was the minster of Higher Education and Scientific Research in Jordan during the period Oct.2003 until April 2005.

Dr. Zabalawi was the Chancellor of the University of Sharjah from 1999-2003. In 1999 he became the Chairman of the Higher Education Accreditation Council of Jordan. In 1996 he became the Vice-President (Scientific and Medical Faculties) of the University of Jordan. In 1994 he headed the Electrical and Electronics Engineering Dept. of the College of Engineering at Sultan Qaboos University, Sultanate of Oman. Between 1989-1993, he served as the Dean of the Faculty of Engineering and Technology, University of Jordan, Amman, Jordan. Prior that he chaired the Department of Electrical and Electronic Engineering at the University, where he taught a number of courses in his field at the undergraduate and graduate levels and he supervised a number of graduate theses.

Dr. Zabalawi was an active member in the higher education development team. He has organized and chaired a number of regional and international conferences and workshops. He is a well-published research scholar. He was a research fellow with the German Academy of Exchange (DAAD) at the University of Karsruhe, the Technical University of Hamburg, and the University of Erlangen, Germany. In addition he was a Research fellow, Electrical Engineering Dept., University of Victoria, Victoria, Canada and Research Fellow with Telenokia, Helsinki, Finland.

Dr. Zabalawi served (1993-1999) as the IEE (Institution of Electrical Engineering, UK.). Council Representative for Jordan and Gulf States. He is a Chartered Engineer and a senior member at the IEEE (Institute

of Electrical & Electronics Engineers, New York, USA, Fellow (FIET), Institution of Engineering and Technology , (IET) UK. He is a member of many societies such as, Circuits and Systems Society, IEEE, USA. Vehicular Technology Society IEEE, USA. Acoustics, Speech, and Signal processing Society, IEEE, USA. Member, Processing Society, IEEE, USA. Member Jordan Engineering Association, 1974.

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Paper reference
SSD08-Plenary-1

Control and safety verification based on a paraconsistent logic program EVALPSN

Kazumi Nakamatsu
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Abstract

I have already proposed a paraconsistent annotated logic program called Extended Vector Annotated Logic Program with Strong Negation (EVALPSN),which can deal with defensible deontic reasoning. EVALPSN has been applied to various intelligent control and safety verification systems such as pipeline valve control, railway interlocking safety verification, etc. Moreover, EVALPSN has been developed to deal with before-after relation between two processes and it can be applied to process time control and process order safety verification. The developed EVALPSN is called bf (before-after) EVALPSN. It will be introduced how to apply EVALPSN and bf-EVALPSN to intelligent control and safety verification with some concrete examples and simulation systems in the speech.

Index-Terms: Control, safety, logic program EVALPSN.

Biography of the speaker: Dr. Kazumi Nakamatsu has been a professor at School of Human Science and Environment, University of Hyogo since 2004. His research focuses on application of formal logics, especially paraconsistent annotated logic program, with applications to computer science area. He has developed a paraconsistent logic program called an EVALPSN (Extended Vector Annotated Logic Program with Strong Negation), and applied it to intelligent control and safety verification for various systems such as railway interlocking safety verification, pipeline valve control, traffic signal control, etc.. He has applied a PAT in terms of intelligent process order control based on EVALPSN. In ad-

dition to the research listed here, Dr. Nakamatsu has published many journal articles, book chapters and conference papers, edited books published by major world-wide publishers, been the editor-in-chief of the International Journal on Reasoning-based Intelligent Systems(Inderscience Publishers,UK) and an editorial board member of some other international journals, and a chair of international conferences and symposium sessions.

Education: Dr. Sci. Informatics (Kyushu University) 1999 M.S. Computer Science (Shizuoka University) 1978 B.S. Computer Science (Shizuoka University) 1976.

Professional Experience: Department of Management and Informatics, Himeji College of Hyogo 4/1990-3/1998. School of Humanity and Environment Policy of Technology, Himeji Institute of Technology 4/1998-3/2004 School of Human Science and Environment, University of Hyogo 4/2004-

Research Interests: Development and Application of the paraconsistent logic program EVALP.

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Paper reference
SSD08-PES-Keynote-Lecture

Reduced Structure Inverter Fed Electric Motor Drives: an Attempt to Improve the Cost-effectiveness, the Compactness and the Reliability of Hybrid Propulsion Systems

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Abstract

The paper deals with an approach to improve the cost-effectiveness, the compactness and the reliability of hybrid propulsion systems, in an attempt to enhance their capability to be competitive with the thermal propulsion systems. This could be achieved thanks to the substitution of the conventional three-leg inverters by reduced structure ones. Of particular interest are four-switch and three-switch-delta inverters. These could be suitably associated to brushless DC and induction motors. This paper develops this idea.

Index-Terms: Four-switch three-phase inverter, delta inverter, cost-effective, brushless motor, induction motor.

Biography of the speaker: Ahmed Masmoudi (S'93-M'97-SM'99) received the BS from Sfax Engineering School (SES), University of Sfax, Tunisia, in 1984, the PhD from Pierre and Marie Curie University, Paris, France, in 1994, and the Research Management Ability degree from SES, in 2001, all in electrical engineering. He joined Schlumberger Ltd, France, in 1984 as a field engineer, then the Tunisian Official Press as the manager of the Phototypesetting Department, in 1985. In April 1988, he joined the Tunisian University where he held different positions

involved in both education and research activities. He is currently a professor of electric power engineering at SES. Professor Masmoudi is the manager of the Research Unit on Renewable Energies and Electric Vehicles (RELEV) of the University of Sfax. He is an associate researcher with Allison Transmission Division of General Motors, Indiana, USA. He is the chairman of the International Conference on Power Electrical Systems organized within the International Multiconference on Systems, Signals and Devices (SSD) since 2001. He is the chairman of the program committee of the International Conference and Exhibition on Ecological Vehicles and Renewable Energies (EVER), organized every year in Monaco, since 2006. He is the chairman of the International Workshop on Electric and Hybrid Automotive Technologies: a biannual workshop organized and supported by the RELEV, since 2003. He is the editor in chief of the Transactions on Systems, Signals and Devices (issues on Power Electrical Systems), published by Shaker-Verlag, Germany. He is the representative of Africa in the European Association for Battery, Hybrid and Fuel Cell Electric Vehicles (AVERE). He is a member of the Society of Automotive Engineers (SAE), Philadelphia, USA. His current research activities are focused towards the design of new topologies of electrical machines and the implementation of advanced, efficient and robust control strategies in drives and generators, applied in automotive as well as in renewable energy systems.

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Paper reference
SSD08-1569117415

Magnetic field calculation under EHV transmission lines for more realistic cases

Adel Mohammed
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Abstract

Ground level electric and magnetic fields from overhead power transmission lines are of increasingly important considerations in several research areas. Common methods for the calculation of the magnetic fields created by power transmission lines assume straight horizontal lines parallel to a flat ground and parallel with each other. The influence of the sag due to the line weight is neglected or modeled by introducing an effective height for the horizontal line in between the maximum and minimum heights of the line. Also, the influences of the different heights of the towers, the different distances of the power transmission lines' spans and the different angles between the power transmission lines' spans are neglected. These assumptions result in a model where magnetic fields are distorted from those produced in reality. This paper investigates the effects of the sag in case of different heights of the towers and when the power transmission lines spans are not parallel to each other.

Index-Terms: OHTL, magnetic field.

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Paper reference
SSD08-1569119104

Simulation of aluminum sheet electromagnetic forming with several dies

Ilhem Boutana and Mohamed Rachid Mekideche
Jijel university, Algeria

Abstract

A numerical method for modeling the deformation and impact that occurs during the electromagnetic forming process is presented. The numerical model employs a strong coupling of the electromagnetic analysis with the plastic structural one. An electromagnetic finite element model is developed to model the time varying currents that are discharged through the coil in order to obtain the transient magnetic forces that are imparted to the work piece. The body forces generated by electromagnetic induction are then used as the loading condition to model the plastic deformation of the work piece using a dynamic finite element modeling. According to the displacement and/or the deformation of the metal sheet, the modeling system is remeshed when a new step begins. Our iterative coupled model accurately predicted the final geometry of the sheet as well as the deformation at each time step.

Index-Terms: Finite element methods, electromagnetic forming, deformation.

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Paper reference
SSD08-1569119316

Thermal modeling and simulation of distribution transformers

Asaad Elmoudi
Sultan Qaboos University, Oman

Abstract

This paper presents a thermal model to predict the top oil and hot spot temperatures of a transformer. The model is applied to 2500 kVA ONAN (without external cooling) distribution transformer equipped with thermo-couples and tested at varying load. A non linear least square algorithm is used based on measurements to determine the model parameters. The model showed good results

Index-Terms: Power transformers, temperature, thermal factors

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Paper reference
SSD08-1569119638

Calculation of magnetic fields and iron losses in a smpm by using vector preisach model and transient finite element analysis

Ali Mansouri, Hafedh Trabelsi and Mohamed Hédi Gmiden
Ecole Nationale d'Ingénieurs de Sfax, Tunisia

Abstract

This work deals with the computation of the magnetics fields and the iron losses in a surface mounted permanent magnet motor by considering a vector hysteresis model incorporated in transient finite element analysis. The use of a vector hysteresis model is required by the non unidirectionnel magnetic fields. The computational method consists of the vector Preisach model (VPM) incorporated into transient finite element analysis (FEA), which are coupled with analytical iron losses models. The rotational behavior of the magnetic fields returns the iron loss modeling and especially the hysteresis ones a difficult task, and so a such model should be able to consider this effect. In this case many models have been studied in order to develop a model fulfilling all the requirements. A special attention is paid to the VPM incorporation and identification, to the B-H relationship in different ferromagnetic regions, to the iron losses calculation, and to the rotating behavior of the magnetic induction.

Index-Terms: Hysteresis losses, vector Preisach model, rotational behavior, transient finite element analysis.

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Paper reference
SSD08-1569106373

Cascade sliding mode control of a field oriented induction motors with varying parameters

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[2] *University of Constantine, Algeria*

Abstract

An adaptive nonlinear sliding mode controller combined with a field orientation scheme has been developed for the control of induction motor to achieve rotor angular speed and rotor flux amplitude tracking objectives. The inputs to the controller are the reference speed, the reference flux, the measured stator currents, the measured rotor speed, the estimated rotor flux, and estimates of the varying non measurable parameters. The unknown load torque and the rotor resistance which may vary during operation. The controller outputs are the reference stator voltages. An accurate knowledge of the rotor flux, the load torque and the rotor resistance is the key factor in obtaining a high-performance and high-efficiency induction motor drive. The rotor flux is estimated using the induction motor rotor-circuit model. Although the estimated rotor flux is insensitive to the stator-resistance variation, it does depend on the rotor resistance. A stable model reference adaptive system (MRAS) rotor-resistance estimator insensitive to stator-resistance variation as well as a load torque estimator have been designed. The use of cascade sliding mode control structure and continuous adaptive update of the machine parameters ensures accurate flux estimation and high-performance operation. Simulation results are presented to verify the stability of the induction-motor drive in various operating modes.

Index-Terms: Induction motor, cascade sliding mode controller design, vector control, parameters estimation.

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Paper reference
SSD08-1569113111

Robust sensorless speed control purpose for induction motors

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Abstract

This paper deals with a new approach of robust sensorless speed control intended to the induction motors. The speed estimation is done from the double use of the so-called self-control process (SCP) of the induction machine which characterizes the relationship between the stator, rotor and mechanical frequencies. Hence, in this approach, the output torque-current controller generates the so-called speed-command instead the conventional rotor-frequency-command. This speed-command gives the estimated speed which added to estimated-rotor- frequency provides the required stator-frequency-command. The conducted simulation and experiments tests attest favorably the robustness, the effectiveness and the simplicity of the proposed approach.

Index-Terms: Induction motor (IM), quasi-steady-state induction machine model (QSS-IMM), self-control process (SCP), sensorless speed control.

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Paper reference
SSD08-1569115954

Backstepping control analysis of two different speed sensorless approaches for induction motor

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Abstract

A new backstepping controller is designed for two different speed sensorless induction motor, based on measurements of stator current. As in field-oriented control scheme, the backstepping analysis generates references for magnetizing flux component and for the speed component of the stator current. The control algorithm is proposed for replacing the existing PI controller to obtain high performance motion control systems, for the speed, flux and currents control loops. Also, the control comes along with a through proof derived based Lyapunov stability theory. Open loop estimator and closed loop observer are used for this purpose and compared in term of their robustness against rotor and stator resistances variations. Simulation results are provided to judge the consistency, effectiveness and performances of this control technique.

Index-Terms: Sensorless control, backstepping control, induction motor, MRAS technique.

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Paper reference
SSD08-1569116068

RFOC of delta-inverter fed induction motor drives with rotor time constant adaptation

Asma Ben Rhouma and Ahmed Masmoudi
Research Unit RELEV, Sfax Engineering School, Tunisia

Abstract

This work is developed within the improvement of the reliability, the cost-effectiveness and the compactness of electric machine drives to be integrated in electric and hybrid propulsion systems. The paper is devoted to the investigation of a three-switch three-phase inverter (also known delta-inverter) fed induction motor drive under a sensorless rotor flux oriented control (RFOC) with an on-line adaptation for the rotor time constant. Both speed and rotor time constant estimators are based on MRAS algorithms. Simulation results clearly show the high performance of drive under the sensorless RFOC strategy and following the on-line adaptation of the rotor time constant.

Index-Terms: Induction motor, three-switch threephase inverter, rotor flux oriented control, MRAS, rotor time constant adaptation, sensorless.

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Paper reference
SSD08-1569117510

Luenberger observer for induction motor operating with parameter variations

Nouha Chaabène, Aida Drira, Mohamed Lassaad Koubaa
and Nabil Derbel

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Abstract

In this paper, a Luenberger observer is developed with the estimation of the rotor resistance and the magnetizing inductance of an induction motor. For the proposed observer, stator currents and rotor speed are assumed to be available. Stator currents and rotor flux are observed in synchronously rotating reference frame using the Luenberger concept. The rotor resistance is derived from Lyapunov stability theory using measured and estimated current and estimated rotor flux. The observer stability is ensured via Lyapunov stability analysis. This work, has three main targets. The first one is to develop an approach to observe the rotor flux, without parameter variations, using the Luenberger technique. The second one is to estimate the rotor resistance and the third one is to observe the rotor resistance and the magnetizing inductance. To demonstrate the efficiency of the proposed approach, numerical simulation results are presented.

Index-Terms: Induction machine drives, Luenberger observer, Lyapunov stability analysis, parameter variations.

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SSD08-1569113780

Factors affecting transient response of grounding grid systems

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[2] *High Institute of Technology- Benha university, Egypt*

Abstract

Grounding system behavior under transient condition is investigated. Transmission line approach has been chosen to simulate the buried grounding system under lightning condition Different models of buried grounding grids have been studied under lightning conditions. Sensitivity analysis of soil parameters and grounding grid dimensions have been studied to understand the effect of each parameter on the performance of grounding systems subjected to lightning.

Index-Terms: Grounding, transient, lightning, ground potential rise.

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Paper reference
SSD08-1569114014

electricity market equilibrium using competitive coevolutionary algorithms with transmission constraints

Ahmed Amine Ladjici and Mohamed Boudour
University of Sciences and Technologies Houari Boumedian, Algeria

Abstract

In this paper, a Coevolutionary approach is used in finding the Market equilibrium of an oligopolistic electricity market considering transmission constraints. The market game is played by bounded evolutionary agents, adapting their strategies to maximize their profits in a competitive environment. This paper considers a centralized market with maximalist ISO. The ISO performs an OPF based on submitted Agents' bid and calculates the power to be dispatched from each supplier, in order to maximize the social welfare and preserve the integrity of the power system, while, market agents interact strategically to maximize their profit. By using competitive Coevolutionary algorithm as a learning algorithm, agents' strategies are led towards Nash-Cournot Equilibrium, where no agent is incited to change unilaterally his strategy.

Index-Terms: terms-competitive coevolutionary algorithms, deregulated electricity market, centralized market, nash cournot equilibrium.

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SSD08-1569114801

A general solution for ring-bus distribution systems reliability

I. Badran, M. Lazim and M.Zeidan
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Abstract

Reliability of power distribution schemes can always be improved at the expense of cost and size. The addition of extra paths proves to increase the continuity of supply. This is really where redundancy steps in, with its two constituents: components redundancy and unit's redundancy. This approach is dealt with in this paper and reliability evaluation for various practical distribution schemes of power supply are considered. A general formula for calculation of ring-main feeders reliability is also developed and applied to these practical distribution schemes. In a ring-bus system, it is found that the reliability of each feeder is decreased by increasing the number of the outgoing feeders, so it is recommended that no more than six feeders are preferable to be connected on such a system.

Index-Terms: ring-bus, distribution systems reliability.

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Paper reference
SSD08-1569117017

Trees growth-current and losses modelling in solid electrical insulations

Nacéra Rouha
University of Béjaia, Algeria

Abstract

This paper presents an attempt of modelling the treeing structures expanding in an insulating polymer. By assuming the treeing shapes to simple geometries and by considering the polymer /tree interface with or without charge, we estabilish a mathemetical expression describing the dynamics of the propagation.This shows the relationship between the treeing length, the current and the loss factor and their dependency on many parameters such as the amplitude, the duration and the shape of the applied voltage, the frequency, the electrode geometry (thickness of the polymer sample, the electrode gap and radius, the density of the polymer, the permittivities and conductivities of both polymer and tree).We also discuss the time- lag to breakdown. We have also led an experimental investigations which results allows us to validate those obtained by the mathematical model, and to show the correlation between the electrical tree propagation (length and time to breakdown) in the case of the different parameters considered.

Index-Terms: Trees, growth-current, modelling, solid electrical insulations

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Paper reference
SSD08-1569117356

Damping the oscillation in an HVDC/ HVAC system with fuzzy controller

Mohammad Bayati Poudeh and Saeid Eshtehardiha
Islamic Azad University, Iran

Abstract

In this paper, the IEEE first benchmark model system which includes two ties (AC and DC), to analysis the stability, is studied. To damp and control the oscillations in this system, after any change in that, a new controller was employed. In this article, the stability of the network is controlled by a fuzzy logic control method. The simulation results show the improvement in the dynamic performance of the test AC/DC system by using the fuzzy logic controller.

Index-Terms: Damping, HVDC/HVAC, fuzzy controller.

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SSD08-1569119447

FACTS allocation for power systems voltage stability enhancement using MOPSO

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Abstract

Location of the static VAR compensator (SVC) and other types of FACTS devices is important for the enhancement of practical power systems voltage stability. In this paper, a Multi-Objective Particle Swarm Optimization (MOPSO) is used to solve a mixed continuous-discrete multi-objective optimization problem in order to find optimal location of FACTS. Various objectives are considered, namely Voltage Stability improvement, real power loss minimization and load Voltage Deviations minimization. Simulations are performed on IEEE 14 test system for optimal location and size of FACTS devices. Analysis of the initial conditions to determine the voltage stability margins and a contingency analysis to determine the critical outages with respect to the voltage stability margin are also examined in order to evaluate their effect on the location analysis. The obtained results show that with the allocation of FACTS devices with the proposed method, the voltage stability is considerably enhanced in both normal state and critical contingencies. The calculation of the load margin demonstrates the effectiveness of the proposed method.

Index-Terms: Static voltage stability, voltage collapse, FACTS location, SVC, TCSC, MOPSO.

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Paper reference
SSD08-1569120898

Apparent power evaluation of series active power filter with recent definitions

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Abstract

The main purpose of this paper is the study of the Series Active Power Filter (APF) compensation capability for different unbalance perturbations of three-phase three wire AC power systems such as voltage unbalance, phaseshift unbalance ,sags and swells. Indeed SAPF has been proved to be an effective solution to compensate for different voltage disturbances in the power system, so that the power system voltages are forced to be balanced and sinusoidal and in phase with the direct component of the power system voltage presented before compensation. The capability of the Series APF is determined by the maximum rate of the apparent power that can be delivered. The challenge now is how these equipments can be dimensioned, this leads to the evaluation of the rate of the apparent power required to achieve this compensations under such conditions. This study present a comparison based on the approaches presented by the definition of the effective apparent power as defined in IEEE 1459-2000, the European school approach and the apparent power classical approach. The two first approaches were proved to be the best methods for the calculation of the apparent power presenting the suitable amount to be concerned in the design process of different devices and allow a good estimation of the Series APF dimensions with low economic burden. This paper presents some application which may be occur in the AC power systems, mainly for three-phase, three-wire AC power systems without neutral wire which can be used for the design process of the Series APF.

Index-Terms: Series active power filter, Unbalance, Apparent power, IEEE 1459-200, European school approach, Design process.

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Paper reference
SSD08-1569112862

Comparison between optislip and fixed speed wind energy conversion systems

Mohamed Khadhraoui and Mohamed Elleuch
Ecole Nationale d'Ingénieurs de Tunis, Tunisia

Abstract

A comparison of the performances between the OptiSlip Pitch Regulated wind system (Vestas V39-600) and a Fixed Speed Stall regulated wind system of the same power. This comparison will relate to the quality of the power generated by each of the two systems and their stabilities following a grid fault.

Index-Terms: aerogenerator, fixed speed, optislip, rotor current controller, pitch controller, stability, grid code requirement.

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Paper reference
SSD08-1569117384

Investigation of the underground temperature using neural network

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Abstract

In this paper, we use the concept of neural networks to evaluate the underground temperature of any type and depth of earth. Two models have been developed for this purpose namely mathematical and intelligent. The mathematical model is developed taking into account properties of the soil and meteorological conditions, whereas the intelligent model is a development of data driven neural network model. Fourth variables influencing the underground temperature which were taken into account are ambient temperature, underground depth, soil thermal diffusivity and days of year. The model was validated against experimental data sets.

Index-Terms: Underground temperature, neural networks, thermal modelling, soil thermal diffusivity.

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Parallel Connected Inverter for Fuel Cell System

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Abstract

This paper presents the design and analysis of a new configuration of parallel connected inverter suitable for fuel cell system application. The configuration consists of dc/dc converter and parallel three-phase dc/ac inverter. Series resistors added to the inverter output to maintain same current in each inverter of the two parallel inverters, and to reduce the circulating current in the parallel inverters to minimum. Third harmonic injection PWM (THIPWM) reduces the total harmonic distortion and to make maximum use of the voltage source. DSP was used to create the THIPWM and the control algorithm for the converter. PID controller is applied on the full-bridge dc/dc converter side to maintain the ac voltage to the required level. Experimental results have been shown to validate the proposed system.

Index-Terms: Three-phase inverter, Third harmonic injection PWM, inverters parallel connection, fuel cell system.

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An overview for the interconnection of renewable energy sources and energy storage systems to the utility grid

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Abstract

There is a great need to connect renewable energy sources such as photovoltaic, wind, and small hydro to the utility system. The same is true for the interconnection of energy storage systems for utility load-leveling which is also called load-71peak shaving. Such systems as batteries, fuel cells, and superconductive energy storage inductors will be given and discussed here in the paper. This presentation at the 5th International Multi-Conference on Systems, Signals and Devices (SSD'08) in Amman - Jordan, July 20-22, 2008 is based on current and new trends for the interconnection of renewable energy sources and energy storage systems to the utility grid. Firstly, the importance of energy for sustainable development by using advanced renewable energy technologies is introduced. Then the photovoltaic, wind, small hydro and fuel cell systems new topology interface are explained. The static VAR control using switching converters with minimum energy storage is also analyzed and discussed. Finally, the effect of interconnection of energy storage systems for utility load leveling to reduce utility load peaks is illustrated.

Index-Terms: Renewable energy, photovoltaic, wind, energy storage, interconnection, svc & power quality.

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Promotion of wind energy in Jordan

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Abstract

Due to the economic growth, increasing population, high fossil fuel cost, and the growing energy demand in Jordan, the provision of reliable energy supply at reasonable cost is considered a crucial element of economic reform. The present study utilizes fuzzy logic methodology to assess wind sites in Jordan and to decide which sites should be given the highest priority respect to their benefits and costs. The criterion of evaluation using fuzzy logic is based on different parameters, *i.e.*, wind resources, prevailing wind direction, above ground level (AGL), site capacity, soil conditions, site elevation, land cost, land roughness, temperature, cultural and environmental concerns, aviation/telecommunications conflicts, nearby resident's concerns, site environmental issues (corrosion, humidity), and distance to transmission line. The results show that Al Harir site in Al Tafila city is found to be the best choice and should be given the highest priority. It is followed by Al-Fujeij in Al-Shawbak then Al-Kamsha in Jerash.

Index-Terms: Fuzzy sets methodology, power generation, wind energy, benefit to cost ratios.

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A novel method for harmonics and low switching frequency eliminations for a three-phase pwm inverter

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Abstract

Harmonics and switching frequency cause a major problem in power system. A novel harmonic elimination technique and low switching frequency in a three-phase pulse width modulation (PWM) inverter are proposed in this paper. This inverter is associated with a LC filter. The technique determines the commutation angles based by solving a set of nonlinear system equations. This commutation angles are determined off-line (Pre-Calculed) and stored in the microcontroller memory in order to speed up the online control of the processes. The pre-calculated switching is modelled to cancel the greater part of low-order harmonics and to keep a single-pole dc voltage across the polarized capacitors. LC filter is designed to cancel the high-order harmonics. This approach allows substantial reduction of the harmonic ratio in the AC main output voltage without increasing the switching-frequency per period. Consequently, the duties of the semiconductor power switches are alleviated. To show the validity of the new harmonic elimination and low switching-frequency, DSP based experimental results are presented. These results are very satisfactory and prove the effectiveness of the new approach.

Index-Terms: PWM inverter, harmonics elimination, switching frequency, dSPACE kit DS1103.

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Zero current and zero voltage static error control of a multi-cell DC/DC converter

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Abstract

In this paper we deal with the control of a two-cell dc/dc buck converter. The design is based on a discrete state space model obtained by expressing current and voltage at the beginning of the $(n+1)^{th}$ period in terms of values of the preceding period. It is shown that the describing model is nonlinear, therefore it is expected that a standard linear controller (e.g. PID) would not be efficient. In this work, we suggest four controllers which are simple to construct. The investigation of their performance is based on linear analysis.

The controllers are designed step-by-step where each next controller improves the action of the previous one. The first controller (C1) is found to be the simplest that can lead to a linear closed loop system, hence it can be considered as a simple input-to-state linearizing controller. With the application of C1 we can only obtain a correct reference current but the voltage remains uncontrollable. The second controller (C2) is the classic proportional controller. Although, it has remedied the problem of voltage controlling, it resulted in a constant static error of the current. After analyzing the first two controllers, a third controller (C3) is designed to achieve the correct reference values.

The only drawback of (C3) was the slow convergence of the current to the desired value. The fourth controller (C4) has been finally suggested to circumvent all the crossed drawbacks of the preceding controllers. The efficiency of (C4) is shown using numerical simulations. The application onto a real circuit is being carried and results will be published in a future work.

Index-Terms: Multi-cell dc/dc converter, buck converter, state space model, control, eigenvalues.

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Self balancing of DC link capacitor voltages using redundant vectors for SVPWM controlled five-level inverter

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Abstract

In this paper, space vector pulse width modulation algorithm for five level diode clamping inverter, with self stabilisation of dc link capacitor voltages is presented. On the base of position of reference voltage vector in space vector diagram, we explain how to choose switching states that will be used to generate the output voltages. The redundancies of some switching states are thoughtfully used to cancel imbalance of dc link capacitor voltages, on the base of a closed loop that use measurements of output and input currents of the inverter.

Index-Terms: Five level inverter, space vector pulse width modulation (SVPWM), DC source balancing.

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Particle swarm optimization and genetic algorithm to optimizing the pole placement controller on cuk converter

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Abstract

In this paper, two different control methods on DCDC Converter, are compared with together. These converters are used for the stabilization or the control of DC voltage of a battery. In addition to other applications, DC converters feed electric vehicles (trucks, electric vehicles, and subway locomotives), telephone sets and civil inverters. Lately, improvement the performance of the DC-DC converter is one of the goals of the engineers in the industries. In this way, several control methods are used to control Cuk converters. In this paper, Pole Placement controller is used to optimize the DC-DC converter performance. Also other controller, by the way, Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) are used with these control methods, to obtain the best coefficients in them. The results are shown the capability of the control methods in the improvement of the above-mentioned converter functioning.

Index-Terms: Particle swarm, optimization, genetic algorithm, pole placement controller, cuk converter.

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Some considerations about MathCAD modeling of the SEPIC converter

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Abstract

At SEPIC converter there are no equations, which summarize the overall behavior of this circuit converter. Determining factors like the throughput power of the circuit and peak voltages and currents, means developing a computer model. In this model the operation of the circuit is broken down into its separated modes and the appropriate equations derived for each of theme. For all modes the time function for the currents and voltages can be derived by circuit analysis. Using Laplace transformation it is possible to derive the time functions for currents in each of its modes. The method allows the initial values of currents and voltage to be easily introduced into equation.

Index-Terms: modeling, steady-state

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