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BOOK 2

COMBINED HIGH-PASS AND POWER-LINE INTERFERENCE REJECTER FILTER FOR ECG SIGNAL PROCESSING

Iliev, I., S. Tabakov, V. Krasteva

Abstract: *In this study we introduce one alternative approach for ECG high-pass filtering and interference rejection based on the simple principle for averaging of samples N with a predefined distance between them D. FilterDxN has a comb frequency characteristic with high-pass cut-off defined by the number of samples N and zeros at the integer ratio of the sampling frequency fs divided by the number of samples D. For a predefined fs, FilterDxN is easily adjusted to different cut-off and zero frequencies only by changing D and N. In this work, we present the mathematical background for deriving the frequency response of FilterDxN, as well as one particular application of the filter, i.e. Filter10x19 designed for fs=250 Hz, high-pass at 1 Hz, zero at 50 Hz. Tests with both standardized and real ECG signals proved that Filter10x19 is capable to remove very intensive baseline wanderings, and to fully suppress 50 Hz interferences with minimal affect on the ECG waveform. FilterDxN would be preferable in ECG systems operating in real time because of its linear filter equation with integer coefficients that hasten the speed of computations.*

MULTILEAD SIGNAL PREPROCESSING BY LINEAR TRANSFORMATION TO DERIVE AN ECG LEAD WHERE THE ATYPICAL BEATS ARE ENHANCED: MATLAB IMPLEMENTATION

Chavdar Levkov, Slavy Mihov

Abstract: *Suggested is an algorithm for ECG signal preprocessing for reliable detection and distinguishing of atypical beats in electrocardiograms (ECG). Derived is an optimal linear transformation from primary lead signals, which maximizes certain criterion for distinction of an atypical beat from the typical ones. This optimal transformation is assumed as a new ECG lead, where the atypical beat is enhanced and can be distinguished easily from the typical ones. The method is verified experimentally with 4-channel ECG data base of 46 records.*

IMPLEMENTATION OF REAL TIME POWER-LINE INTERFERENCE REMOVAL PROCEDURE FROM ECG

Slavy Mihov, Ratcho Ivanov, Angel Popov

Abstract: *Presented is the algorithm of the subtraction method for removing powerline interference from ECG signals, in case of powerline frequency variations. The existing MatLab prototype version is adapted for real time execution on DSP and programmable logic (FPGA) platforms. The algorithm is ported and experimented in case of odd sample number in one period of the interference. The corresponding formulas for even sample number are given too. Test results of the prototype MatLab code and its two implementations (for DSP and FPGA) show that the presented real time algorithms successfully compensate the presence of powerline frequency interfering the ECG signal. Given are the changes in the DSP port of the algorithm and the generated structure by the FPGA configuration code.*

GENERALISED EQUATIONS AND ALGORITHM OF THE SUBTRACTION PROCEDURE FOR REMOVING POWER-LINE INTERFERENCE FROM ECG

Georgy Mihov, Ivan Dotsinsky, Chavdar Levkov, Ratcho Ivanov

Abstract: *The present work generalises the subtraction procedure, which removes the power-line interference without affecting the components intrinsic to the ECG. It is based on previous investigations, dealing separately with the cases of odd and even multiplicity/non-multiplicity between the sampling rate and the power-line frequency. The study proposes an integration of both cases, using common equations and algorithm. The theoretical conclusions are implemented in a program written in MATLAB environment. The algorithm and the program are tested by many particular cases and the introduced errors are evaluated. The work represents a suitable platform for accurate investigation, analysis and development of the subtraction procedure.*

TEST GENERATOR FOR EXAMINATION OF PLL AND DDS SYSTEMS

Aleksandar Yordanov

Abstract: *This paper describes a test generator for examination of digital and analogue phase locked loop and digital synthesizers. In practice very often are used signals with various types of shapes and frequencies. For high precision signals mostly are used PLL and DDS generators. The device described in this paper is based on a digital synthesizer and a phase locked loop. With this test generator could be examined different types of phase detectors and low-pass filters which are the essence of every PLL. An algorithm is proposed for assessment of phase locked loops.*

PERFORMANCE OF A STATION FOR LONG TERM MONITORING OF THE ATMOSPHERIC GROUND LAYER STATUS IN URBAN SITES

Mityo Mitev, Ludmil Tsankov

Abstract: *The performance of a station for long term atmospheric monitoring situated at the Astronomical Observatory of the Sofia University in Sofia is considered. The ability of the station to register the change in the environmental radiation due to changes in the meteorological status of the atmosphere is demonstrated. The long term efficiency and stability of the station are analyzed. Some suggestions aimed at the increasing the stability of the logarithmic gamma-spectrometer are discussed.*

RESEARCH ON THE METROLOGICAL CHARACTERISTICS AND STABILITY OF GAMMA-DOSIMETERS USING SWFM

Mityo Mitev, Emil Dimitrov, Diana Hristova

Abstract: *In this work we discuss the problem of precise energy calibration of gamma-dosimeters, using the Spectral Weight Function Method (SWTM). We provide some comparative measurement results for the dose rate, gathered using the aforementioned method and through spectrometric measurements.*

Keywords: γ-dosimeter, SWFM, energy calibration, comparative measurements

FEASIBILITY ASSESSMENT OF THE SMART STANDARTIZED SENSORS DESIGN FOR VEHICLE TESTS AND DIAGNOSTICS

Georgi Dotsov Geshev, Emil Nikolov Dimitrov

Abstract: *The paper examines the basic principles set by the IEEE 1451 standards. A review of the current status of the standards has been made. Some recommendations are given how to design electronic monitor systems with a variety of requirements taken into account. The paper is focused on a vehicle real-time diagnostic systems design. The developed idea is based on the IEEE 1451.4 standard and provides a mixed analog and digital data transmission. The possible transducer electronic data sheet (TEDS) implementations are examined: basic, extended and virtual.*

SMALL LOCAL NETWORK FOR MICROPROCESSOR CONTROLLERS

Tsvetan Shoshkov, Georgy Mihov, Ventsislav Manoev

Abstract: *This article deals with the matter of developing of a driver for small local field network for microprocessor controllers in information controlling systems. As a basis it is used the structure of a small local network driver, developed in Technical University of Sofia. It is processed to work according to a standard protocol under the specification of Modbus. Thus the existing network is made universal and there is a possibility for connecting it in other systems, using the open standard of the Modbus specification. The existing logical rules for the organization of the user and service programs of the controllers and the rules for communication are not changed. The driver is written in C programming language that makes it easy for using by different microprocessors. The driver is with simple structure, it is easy for using and optimization.*

STUDY OF POWER AND RIPPLE FACTORS OF CONTROLLED THYRISTOR RECTIFIERS

Evgeniy Popov, Liliya Pindeva, Sergey Hristov

Abstract: *Controlled thyristor rectifiers provide regulatable output d.c. voltage, current and power necessary in many power application by phase control of the moment of turning on the devices. But at the same time the power factor in respect to the supplying mains is decreased that leads to an additional loading of the system for generation and distribution of electrical energy. That is rather important nowadays taking into account the struggle against the global warming. On the other hand the phase control causes increased pulsations of the rectifier voltage, measured by the ripple factor. To remove the undesirable ripples inflicted by the phase angle regulation larger filters are required. Different rectifiers behave differently in respect to the power and ripple factors. The aim of this article is to study the most commonly used types of controlled thyristor rectifiers and to clarify, and compare the information concerning their power and ripple factors.*

Keywords: power factor, ripple factor, voltage control, thyristor rectifiers.

AIR PRESSURE MEASUREMENT USING SILICON BASED ANALOG SENSOR SPD015A

Petar Sapundjiev, Mityo Mitev, Ventseslav Manoev

Abstract: *The aim of this work is to examine the properties of analog pressure sensor SPD015A and it's use in atmospheric pressure measuring system. Special attention has been paid at the problems related with the temperature dependence of the sensor. Two methods for temperature compensation are described: one by using mathematical procedure and other by using hardware means. Results from the measuring process are represented in order to examine the problems and the methods for their solution.*

Keywords: air pressure, temperature dependence, compensation

COMPUTER CONTROLLED SETUP FOR TEMPERATURE MEASUREMENTS FOR THIN FILM DEPOSITION

Ivaylo Jivkov, Deyan Dimov, Mariya Aleksandrova, Julien Petkov, Vladimir Denishev

Abstract: *Computer controlled module for temperature measurements with thermocouples based on microcontroller PIC18F2620 is developed and tested. It consists of thermocouples, preamplifiyers, microcontroller PIC18F2620 and serial interface unit.*

The software configures the microcontroller for temperature measurement, implements a temperature calibration (on a request of the user) and executes a measurement.

Keywords: temperature measurement, processing of sensor signals, data acquisition and control.

INVESTIGATION AND DESIGN OF HIGH CURRENT SOURCES FOR B-H LOOP MEASUREMENTS

Boyanka Nikolova, Georgi Nikolov

Abstract: *Presented paper describes investigation and design approach for voltage controlled high current sources. The designed circuits are proposed for development of measurement system for B-H magnetic hysteresis analysis. Using the presented circuits and applying the concepts of virtual instrumentation, the laboratory experiments for investigation of ferrite torroids' parameters can be improved. In presented investigation two basic forms of voltage controlled current source using power operational amplifier are selected. The design process is accomplished using electronic design automation environments. Applying modern simulation technique, inductive load to test frequency transfer function is derived and presented graphically. Such design approach give opportunity to significantly simplify the design process, facilitate prototyping and reduce time-to-market in order to produce low-cost measurement systems or sensor platforms with fair metrological performances.*

Keywords: *B-H* loop measurement, Ferrite toroidal cores, High current source, Inductive load, SPICE simulation.

HIGH CURRENT SOURCE-MEASURE UNIT BASED ON LOW COST DAQ

Georgi Nikolov

Abstract: *The development of a high current source-measure unit based on multifunctional low cost data acquisition board, graphical development environment and a circuit of voltage controlled current source is presented in this paper. Such development is motivated by capability of source-measure units to acquire data, generate I-V curves, and otherwise characterize various device performances. As a part of proposed development some considerations concerning high current sources are presented and some aspects of circuit design are treated. Because the circuit traditionally is used only as current generator, in this paper is suggested innovative approach to use this current source as voltage generator. The approach consists basically in implementation of software loop that continuously calculate resistance of device under test and control the output voltage. The developed virtual system can be used for circuit and device evaluation, where a DC signal must be applied to a device under test and the response to that signal must be measured.*

Keywords: Device characterization, LabVIEW, Source-Measure Unit, Virtual Instruments, Voltage Controlled Current Source

DESIGNING AN OPTOELECTRONIC CHARACTERIZATION SYSTEM FOR AN EDUCATIONAL LABORATORY

Todor Djamiykov

Abstract *This paper describes a simple, cost-effective parameter analysis system, built of low-cost data acquisition module, easily obtainable components and programmed using a graphical programming environment. The system is designed for educational purpose and can be used for static characterization of optoelectronic devices, sensors and other semiconductors. In the presented paper is considered some topics concerning the connectivity between data acquisition board and integrated parametric measure unit. Such considerations are important in order to achieve accurate I-V characteristics of investigated optoelectronic devices. The designed system's hardware is powerful and capable of performing a more of the tests required for the laboratory experiments.*

Keywords: Data acquisition, I-V characteristics, Optoelectronic, Parametric Measure Unit, Virtual instrumentation

A SELF - TUNING OF THE PID CONTROL LOOPS BASED ON THE ZIEGLER NICHOLS FREQUENCY RESPONSE METHOD

Eftim Stoyanov, Atanas Iovev

Abstract: *The Ziegler Nichols frequency response method is widely used for optimal tuning of the PID control systems. There are some difficulties in the method application in the industrial plants. Looking for the limit of stability, there is a danger to make the control system unstable, which may result an industrial accident. To find a limit of stability of the industrial control systems is a serious time consuming task. Using an automated tuning solves particularly these disadvantages, but it requires a highly qualified specialist to lead the process. In order to facilitate the using and to improve the safety, a Process Oriented Language program unit is developed for self – tuning of the PID control loops for Distributed Control Systems.*

Keywords: Self - Tuning of the Control Systems, Process Control.

THERMAL PROCESSES IN HIGH POWER LED

Dimitar Todorov

Abstract: *High Power LED's have been around for years, primarily concentrated as the lighting source for a variety of applications. Nowadays, LED technology is the leading choice for interior and exterior automotive and lamp street lighting. Although LED light sources offer many advantages, special considerations apply to their use in the application. Their electrical properties the optical parameters of LEDs a depend a mainly on junction temperature .Like other electronic components, LEDs have thermal characteristics and limitations. The junction temperature of the power LEDs affects the device's luminous flux, the color of the device, and its forward voltage. For this reason thermal characterization play important role in case of high power LEDs and necessitating both physical measurements and simulation tools.This paper gives an overview of the topic thermal processes of LEDs for them use in automotive and lamp street applications and presents the results of case studies through numerical modelling.*

Keywords: High-power LED, Junction temperature, Thermal management

INVESTIGATION OF DIGITAL PHASE DETECTORS

Georgi Kachakov, Georgy Mihov, Aleksandar Yordanov

Abstract: *This article deals to describe the simulation and the experimental investigation of the basic types of digital phase detectors and especially acquiring their phase-voltage response. This phase-voltage response represents the output voltage of the phase detector as a function of the phase difference between the digital input sequences. It is examined an exemplary implementation of specialized tester, intended for experimental analysis of phase detectors. It is described the significance for choosing the next block in the phase-locked loop system (the low-pass filter-integrator). It is also done an analysis and comparison of the results, obtained from both the simulation and experimental environment.*

MULTIFUNCTIONAL PROTECTION RELAY INPUT MODULE MODERNIZATION

Nikolay Tuliev, Stefan Ovcharov, Peter Yakimov, Emiliya Balkanska

Abstract: *The paper describes the advantages of the modern numerical protection relays. It is proven that the accuracy depends mostly on the input module. Different approaches in design of current and voltage input transducers are mentioned. After studying the parameters and characteristics of the latest integrated circuits of operational amplifiers and ADCs a new design of the analog input module is proposed. A detailed description of the hardware of the module is presented. After investigation of the circuits recommendations for better operation are given.*

Keywords: Protection relay, ADC, measurement

BEHAVIORAL MACROMODELING OF VOLTAGE FEEDBACK AMPLIFIERS

Ivailo Pandiev

Abstract: *This paper presents a new voltage feedback amplifier macromodel at behavioral level. It accurately models basic differential-mode and common-mode electrical characteristics, the input offset voltage and current, the differential-mode and common-mode amplification, the input voltage noise, the output voltage swing, short-circuit current and the input and output impedances. For creating the model, simplification and build-up techniques known from modeling operational amplifiers have been adapted. Model parameters are extracted for the OP177F from Analog Devices as an example. To confirm the validity of the proposed macromodel, simulation results are compared with the manufacturer's data and with the behavior of the SPICE-based macromodel OP177F/AD from the standard library. The proposed behavioral macromodel leads to a low analysis time, with higher accuracy and a better convergence in comparison with other op amps methods of modeling.*

Keywords: analog circuit design, voltage feedback amplifier, behavioral modeling, simulation.

BEHAVIORAL MACROMODELING OF CURRENT FEEDBACK AMPLIFIERS AND DRIVE-R – AMPLIFIERS

Ivailo Pandiev

Abstract: *This paper presents new current feedback amplifier and drive-R – amplifier macromodels at behavioral level. They accurately models basic differential-mode electrical characteristics, the offset input voltage and current, the input voltage noise, the output voltage swing, short-circuit current and the input and output impedances. For creating the model, simplification and build-up techniques known from modeling voltage feedback amplifiers have been adapted. As examples model parameters are extracted for the AD8001 and OPA860 from Analog Devices and Texas Instruments, respectively. To confirm the validity of the proposed macromodels, simulation results are compared with the manufacturer's data. The proposed behavioral macromodels leads to a low analysis time, with higher accuracy and a better convergence in comparison with other op amps methods of modeling.*

Keywords: analog circuit design, current feedback amplifier, drive-R – amplifier, behavioral modeling, simulation.

ELECTRO-OPTICAL DEVICE PARAMETERS MODELING

Katya Asparuhova, Todor Djamiykov

Abstract: *This paper presents electro-optical device parameters modeling for OrCad Pspice simulator. Electro-optical parameters of photodiodes, LEDs and laser diodes like total output power, spectral sensitivity, optical power vs. current are modeled using ABM method. The modeled relations are fitted using MATLAB which is resulting in good accuracy. The models are implemented in the OrCad PSpice simulator as subcircuits.*

Keywords: photodiodes, LEDs, laser diodes, Spice, MATLAB

AN APPROACH TO PASSIVE CIRCUIT SYNTHESIS USING GENETIC ALGORITHMS IN MATLAB – BAND-PASS FILTER

Vladislav Durev

Abstract: *An approach to passive circuit synthesis in MATLAB is proposed in the present paper. The Modified Nodal Analysis is used for the construction of the admittance circuit matrix. A circuit of passive band-pass filter is used for the demonstration of the method. The algorithm is easy to implement in MATLAB environment. A methodology for the verification of the developed approach is proposed together with structural-parametric optimization of the circuit.*

Keywords: Genetic Algorithm (GA), Modified Nodal Analysis (MNA), Circuit Synthesis

APPLICATION OF POSTPROCESSING FOR OBJECTIVE FUNCTION FORMULATION IN THE STATISTICAL OPTIMIZATION USING PSPICE

Elissaveta Gadjeva, Dimitar Shikalanov

Abstract: *An approach is proposed in the paper to automated statistical circuit optimization using the general-purpose circuit analysis program Cadence PSpice. The selection of the optimal variant is based on postprocessing in the graphical amalyzer Probe. The objective functions are formulated and calculated using corresponding macrodefinitions.They are defined as corresponding modules for optimization, introduced in Probe. The optimal values of the circuit parameters are also obtained in the graphical analyzer Probe using predefined macros using simulation results in the frequency or in the time domain. The statistical PSpice optimization allows the application of the rich possibilities of Probe graphical analyzer for construction complex objective functions, multi-extremal, as well as non-differetiable functions. Examples are presented to illustrate the proposed approach.*

Keywords: Statistical optimization, *PSpice* simulation, Objective functions

SPICE SIMULATION OF THE CONTROL SYSTEM FOR FREQUENCY REGULATED TRANSISTOR RESONANT INVERTER

Georgi Kunov, Elissaveta Gadjeva, Todor Dimov, Borislav Philipov

Abstract: *The paper subject of research is synthesis and SPICE simulation of a system for frequency control and regulation of series resonant transistor inverter. A characteristic feature of the system is the tracking of an only one synchronization signal. That is the current in the resonance loop. This approach is extremely preferable when the heat station (HF coupled transformer, tank capacitor and inductor) is distanced from the energy unit. Adaptive dead time control is incorporated in the system, which is a function of the current through the switches at the moment of commutation. The control system automatically limits its minimal working frequency, supporting a minimal commutation lead time of transistors, before the zero-crossing of the current through them. This ensures ZVS in the whole frequency range.*

Keywords: Transistor resonant inverters, Spice simulation, Control system

RESEARCHING ELECTRONIC PORTOLIOS: EDUCATIONAL AND PROFESSIONAL DEVELOPMENT THROUGH TECHNOLOGY

Elena Shoikova

Abstract: *The use of ePortfolios in distributed learning in higher education and corporate training worldwide has increased over the last years. An ePortfolio is a highly personalized, customizable, web-based information management system, which allows students to demonstrate individual and collaborative growth, achievement, and learning over time. ePortfolios are beginning to be used as tools for personal development planning, lifelong learning, and learning in the workplace. The paper describes major types of ePortfolios in accordance with the IMS ePortfolio Specifications and an ePortfolio model that could be useful to plan the introduction and the implementation of an ePortfolio in electronic engineering education.*

Keywords: ePortfolio, distributed learning, competency based learning, learning design

ELECTRONIC PORTFOLIO BUILT INTO WINDOWS SHAREPOINT COLLABORATION AND LEARNING ENVIRONMENT

Elena Shoikova

Abstract: *This paper reports work-in-progress for a project to create an electronic portfolio for the Technical University-Sofia students. It outlines the components of the project being undertaken and the processes that students will experience. The paper presents the process of electronic portfolio development through five stages and its implementation in the SharePoint Platform for collaboration, communication and learning developed at the Technical University-Sofia R&D Laboratory on eLearning Technology and Standards. The ePortfolio is emerging as the latest tool in professional development, for documenting in-service achievements, career management and seeking employment. Considerable portfolio development has occurred in the field of competency based lifelong learning applying the portfolio as a professional tool. The ePortfolio for English Language Faculty of Engineering students will be trialed in MEng E-Management class during Semester 1, 2008 in a course on E-Learning. An ePortfolio for Master program students will enhance the professional practice portfolio component of their academic program, building throughout each year of the program (and on into their career). The ePortfolio consists of more than an electronic storehouse for a resume and copies of evidence. It includes a self-learning process to help students identify gaps in their current portfolio. The main feature of this process realized as an interactive web solution built in the SharePoint platform, will allow students to identify and reflect their existing skills, competencies and experiences. These capabilities may be compared to examples of job descriptions and corresponding competence profiles. In this way the students can identify if they need additional paid or voluntary work experience or additional skills to meet specific job requirements.*

Keywords: *electronic portfolio, social network, competency based learning*

A PRACTICAL APPROACH TO DESIGN AND MODELING DIGITALLY PROGRAMMABLE ANALOG CIRCUITS

Ivailo Pandiev, Peter Yakimov, Doycho Dimitrov, Todor Todorov, Veselin Stanchev

Abstract: *In this paper, practical approaches to design and macromodeling digitally programmable analog circuits are described. The proposed design approaches are based on the design methods for analog circuits, the procedures for performing simulation projects and the general methodology for building Web-based client/server applications. Those methods are complete framework, which includes all activities, intermediate products, design procedures and relations between them, necessary for design and realization of a concrete electronic circuit and a relevant simulation macromodel. The design approaches are applicable to a broad class of circuits that amplify and convert analog signals under digital control codes, such as programmable gain amplifiers (PGAs), in-amps, sample-and- hold amplifiers (SHAs), digitally programmable active (RC and SC) filters and oscillators.*

Keywords: digitally programmable analog circuits, design methodology, analog circuit macromodeling method.

AN ELECTRONIC SYSTEM FOR DIGITALLY PROGRAM MABLE ANALOG CIRCUITS STUDY

Ivailo Pandiev, Peter Yakimov, Doycho Doychev, Todor Todorov, Veselin Stanchev

Abstract: *In this paper we present a specific electronic system for analysis and design of digitally programmable analog circuits. The created electronic system is with module structure and envelops specific circuits such as programmable gain amplifiers (PGAs), attenuators, analog circuits with CMOS digital potentiometers, active filters, direct digital synthesis (DDS) waveform generators, digital circuits with microcontroller, etc. In particular the system consists of the following six separate electronic modules: (1) electronic circuits with CMOS digital potentiometers; (2) electronic circuits with monolithic PGAs; (3) programmable active RC and SC filters (4) monolithic direct digital synthesis (DDS) generators; (5) digitally-controllable audio electronic systems; (6) HF PLL synthesizer. For some of the modules, PIC microcontrollers are programmed with Evaluation PIC 18 board (version 1.0). The Evaluation PIC 18 board includes programmer, communicational channel for personal computer and connectors to additional sensors. The electronic system, presented here, is intended for laboratory practice with students in Electronics in the Technical University of Sofia.*

Keywords: analog circuit design, digitally programmable analog circuits, electronic modules, PGA, CMOS digital potentiometers, direct digital synthesis, PLL.

INVESTIGATION AND DEVELOPMENT OF ELECTRONIC INSTRUMENTS FOR PLC PROGRAMMING TRAINING

Peter Yakimov, Nikolay Tuliev, Atanas Iovev, Stefan Ovcharov, Emiliya Balkanska, Georgy Mihov

Abstract: *Programmable logic controllers have been gaining popularity on the factory floor and nowadays are the most common choice for manufacturing controls. Because of the nature of a specific industrial object or manufacturing process it is impossible by reason of security the program adjustment to be performed in real conditions. Thus simulators are designed to mimic real-world environments and they can provide a safe and risk-free platform for job training, project testing, design engineering and troubleshooting. The goal of the present project is a simulator for PLC programming training to be developed.*

Keywords: PLC, simulation, test, training

METHODOLOGY FOR TEACHING BASIC SKILLS IN PLC PROGRAMMING DEVELOPMENT

Atanas Iovev, Peter Yakimov, Nikolay Tuliev, Stefan Ovcharov, Emiliya Balkanska, Eftim Stoyanov

Abstract: *The teaching and training of the students in the field of Programmable Logic Controllers (PLC) is very important, because it determines the safety and the quality of control. This paper describes the various parts of the PLC and demonstrates some software for performing tasks using some of the next typical instructions: Bit Logic Instructions, Move and Conversion Instructions, Timer Instructions and Counter Instructions. The experiments give students knowledge and practice with the basic PLC functions.*

Keywords: PLC, Timer, Counter, lab exercises

PRACTICAL TRAINING IN AUTOMOTIVE ELECTRONICS

Tania Vasileva, Vutko Draganov, Mihail Tzanov, Filip Koparanov, Vassiliy Tchoumatchenko

Abstract: *The increase in complexity of modern cars also increases the demands placed on diagnostics, maintenance and repair. The paper outlines the design and implementation of blended learning course for training in Automotive electronics and OBD diagnostic. Developed practical exercises with emphasis on engine performance test and OBDII diagnostic are discussed. Topics with increased complexity dedicated to training in three professional levels are considered. Teaching aims and results of conducted pilots with car mechanics and employers from car garages are also outlined.*

Keywords: automotive electronics, OBD diagnostic, practical training

TOOL FOR SYNCHRONOUS COMMUNICATIONS IN COLLABORATIVE ENVIRONMENT

Ivan Furnadziev, Vassiliy Tchoumatchenko, Tania Vasileva

Abstract: *The paper outlines the design and implementation of end-user applications for networking and community building in shared collaborative environment. It covers features, architecture and user interface of the Chat tool, dedicated for synchronous communications in Shared Space. Chat tools aim to facilitate contextualized user communications and ideas exchanging when working on shared objects. All implemented features help in collaborative knowledge creation and facilitate reflection of shared knowledge and practices.*

Keywords: Collaborative learning, synchronous text communication

VALIDATION OF ANONYMOUS SURVEYS OF EDUCATIONAL SUBJECTS THROUGH THEIR BASIC RESULTS

Valentin Videkov, Rossen Radonov, Russy Tsolov

Abstract: *The paper presents the development of an anonymous survey system using the Internet for the purposes of the System for Assessment and Maintenance of the Quality of Education (known as SOPKO) at the Technical University of Sofia. Some of the results processing functions and means for guaranteeing the process' authenticity are described. Some survey results used as parameters, which could be checked externally, are suggested. The first results from the system's implementation are shown.*

Keywords: anonymous survey, Internet, validation, quality, education

CONTACTLESS THERMAL CHARACTERIZATION METHOD OF SWITCHING MODE POWER SUPPLY

Anna Andonova, Ekrem Tural, Andrew Andreev

Abstract: *This article presents results from the creation of switching mode power supply and non-contact thermal characterization of the separate elements that presents the risk of its reliability. Thermgraphics for several loads of different components are taken by infrared (IR) camera FLIR P640. The developed non-contact method is realized on the base of software engine for colour graphical analyzes of IR images optimized for parallel execution in grid environment. The method appliance leads to materially decreasing the time for development and implement due to the fats results and the non-contact diagnostics of heat-conducting in the researched electricity supplying device. Main appliance considered, when a primary thermal simulation is not conducted, but it is needed a real time thermal regulation and without building bundle of countless temperature sensors.*

Keywords: Switching mode power supply, Infrared radiation, IR thermography

THERMOGRAPHIC INSPECTION OF RELAYS FOR RAILWAY SAFETY EQUIPMENT

Anna Andonova, Emil Ivanov, Andrew Andreev

Abstract: *The following article presents results of the implementation of thermomonitoring methods followed up by processing of IR images. Field purpose is diagnostics of contacts wearing-out in the relays for railway safety equipment. Acceleration testing has been performed for contacts wearing-out in the relays under alternating current (AC). In real environment a commutation thermographics has been recorded in sequences mode with IR camera model FLIR P640. Specially developed software is used for digital processing of the images. Serving the Railway automation, criteria for early diagnostics of "bad" contacts in relays have been developed.*

Keywords: Thermographic inspection, Railway safety equipment, Reliability.

DESIGN AND INVESTIGATION OF A THERMAL ACTUATOR

Marin Hristov, Tihomir Takov, Ivelina Cholakova, Krassimir Denishev, Vladimir Grozdanov, Dobromir Gaydazhiev

Abstract: *Recently, there is tremendous interest in Micro Electro Mechanical Systems (MEMS) technology. MEMS refer to a collection of microsensors and actuators that can sense environment and have the ability to react to changes, with the use of a microcircuit control. Microelectromechanics have accomplished phenomenal growth over the past few years, due to rapid advances in theoretical developments, experimental results and high-performance compute design software.*

Thermal actuation has been extensively employed in MEMS. It includes a broad spectrum of principles, such as thermal pneumatic, shape memory alloy (SMA) effect, bimetal effect, mechanical thermal expansion, etc. Thermal actuators can generate relatively large force and displacement at low actuating voltage.

Keywords: MEMS, Thermal actuator, Surface micromachining, PolyMUMPs

DESIGN AND SIMULATION OF ACCELEROMETER SPRINGS

Marin Hristov, Kiril Toshev, Krasimir Denishev, Vladimir Grozdanov, Dobromir Gaydazhiev

Abstract: *With the development of MicroElectroMechanicalSystems (MEMS), inertial instruments have seen significant progress over the past decades. The advantages of low-cost, low-power, small size, batch fabrication, makes MEMS-based inertial sensors have a wide range of applications in automotive, consumer, computer, and navigation markets. An accelerometer is internal sensor used to measure acceleration. This MEMS-based accelerometer uses a capacitive-sensing scheme for acceleration detection.*

This paper presents the design and simulation of two kinds of springs, built on the same principles, with different geometry parameters. The main aim of the work is to find, how the accelerometer parameters are changed, by using of different springs to attach the proof mass. Different spring types have different spring constants, depending on their geometry parameters like width, length, effective mass etc. We are going to find out, how the range of measured acceleration changes, if we use modified spring parameters.

Keywords: MEMS, Accelerometer, Spring, PolyMUMPs, SoftMEMs and ANSYS CAD systems

DESIGN AND INVESTIGATION OF AN ACCELEROMETER

Marin Hristov, Plamena Veleva, Krasimir Denishev, Vladimir Grozdanov, Dobromir Gaydazhiev

Abstract: *The past few years have witnessed an increasing maturity of the MEMS industry and a rapid introduction of new products addressing applications, ranging from biochemical analysis to fiber-optic telecommunications. The market size for MEMS products has doubled in the past 5 years and is projected to grow at this fast rate for the foreseeable future. The corresponding technology has enjoyed a fast pace of development and has rapidly spread to institutions and companies on all inhabited continents.*

MEMS accelerometers are one of the simplest but also most applicable microelectromechanical systems. They became indispensable in automobile industry, computer and audio-video technology. This paper presents the design and simulation of an accelerometer with default and not default tether (two different sets of tethers) and investigates the displacements to x,y,z-axis.

Keywords: MEMS, Accelerometer, PolyMUMPs, Surface Micromachining

DEVELOPMENT OF PARAMETERIZED CELL OF SPIRAL INDUCTOR USING SKILL LANGUAGE

Vladimir Grozdanov, Diana Pukneva, Marin Hristov

Abstract: *In this paper is presented a method to facilitate the process of design RF circuits and systems using standard industrial CAD system CADENCE. Parameterized cell of square spiral inductor is proposed. It is created using built in Cadence language – SKILL. The use of a standard cell where the geometry parameters of the inductor can be set and change whenever necessary makes the design of inductors and their application in bigger circuits faster and easier and allows much more flexibility. In addition Spectre model is integrated in it, based on the well-known physical model of spiral inductor. Physical verification rules that extract the real parameter from the layout are also written in order to make the parameterized cell complete.*

Keywords: CAD, Microelectronics, SKILL, p-cell, inductors

SIMULINK MODELING OF SIGNAL CONDITIONING CIRCUIT FOR INDUCTIVE DISPLACEMENT TRANSDUCER

Mihail Tzanov, Filip Koparanov, Emil D. Manolov

Abstract: *This paper presents the developing and examining a Simulink model of signal conditioning circuit for Inductive Displacement Transducer (IDT). To this aim the basic specifications of IDT WA200 sensor are studied and Simulink behavioral model is proposed. The two most popular methods for signal conditioning of IDT output signal are described and Simulink model based on dual half-rectifiers is synthesized. The models are utilized to study and predict the performance of the integrated IDT sensor interfacing block. The obtained results are applicable in the design and verification of ASICs and SoCs.*

Keywords: Simulink, Inductive Displacement Transducer, Signal conditioning

FPAA PROTOTYPING OF SIGNAL CONDITIONING CIRCUIT FOR INDUCTIVE DISPLACEMENT TRANSDUCER

Filip Koparanov, Mihail Tzanov, Emil D. Manolov

Abstract: *The paper presents the results from the design and investigation of FPAA based signal conditioning circuit for Inductive Displacement Transducer (IDT). The design utilizes Simulink behavioral model of the signal conditioning circuit based on dual half-wave rectifiers. The synthesized FPAA prototype is simulated and practically examined employing WA200 IDT sensor. The obtained results confirm the efficiency of the proposed solution. The discussed circuit is applicable in the development of switched-capacitor signal conditioning blocks for ASICs and SoCs.*

Keywords: FPAA, Inductive Displacement Transducer, Signal conditioning

INTERFACE CHARACTERIZATION OF PPV – DERIVATIVE BASED STRUCTURES BY DIRECT CURRENT ELECTRICAL MEASUREMENTS

Mariya Aleksandrova, Georgi Dobrikov, Ivaylo Jivkov, Deyan Dimov, Milka Rassovska

Abstract: *Polyphenylenevinylene derivative (PPV – D) based structures with Ohmic and Schottky electrodes have been produced and investigated by direct current–voltage (I-V) measurements. Polymer solutions with different solvent concentrations are prepared and dependence of the film thickness on the amount of solvent is established. It was found that in structures of type Au|PPV-D|Al Ohmic electrodes are formed, whereas ITO|PPV-D|Al samples behave as Schottky diodes. Schottky barrier of 0.2 eV at the ITO|PPV-D interface (anode) was established. Dependence of the conductivity in Au|PPV-D|Al samples on the PPV-D film thickness was found. It shows that bulk conditions dominate the conductivity process rather than contact limited processes. The slope of the I-V characteristics increases linearly decreasing the film thickness. Measurement of 100 nm thick Au|PPV-D|Al samples differs from the linear dependence. It could be referred to a double charge carrier injection from both electrodes. The results obtained are basic point to a further electrode optimization of organic based light emitting diode and solar cell structures.*

Keywords: Organic/metal interface; Ohmic and SCLC conductivity; Polymer based diodes.

INDUCTORS INFLUENCE OVER THE DC-DC CONVERTER PERFORMANCE

Tihomir Brusev, Peter Goranov

Abstract: *This paper concerns the technological limitation of fully monolithic dc-dc converters. Two types of circuits were investigated on AMS CMOS 0.35 μm process. Comparison between efficiency results of architectures used on-chip and off-chip filter's inductors are made. The inductors influence over the dc-dc converters performance is evaluated. Input voltage of 3.6V, which is the normal voltage for Lithium-Ion battery cell that is typically used in battery-powered devices, is chosen.*

Keywords: *dc-dc converter, inductors, efficiency, CMOS 0.35 μm technology*

POSSIBILITIES OF IMPROVEMENT OF MONITORING AND DIAGNOSTIC PROCESS OF POWER ELECTRONIC DEVICES

Vladislav Veselinov

Abstract: *In the present article are analyzed the possible break-down situations in the internal electric circuits of power rectifier convertors. The main task is a theoretical report of the developing processes during the occurance of internal short circuits under a failure of one or several valves and their influence upon the rest of them. The available possibilities for an optimal defence and the methods of their registrating and measuring are considered. They are applied in the digital complex introduced in the laboratory LAMAR of UCTM designed for research and control of the working process of power electronic devices. The complex is an adaptive system, which adjust the working regime towards the changes of the charges. The main ways for reducing the heat influence of the break down current through the undamaged valves are defined. The suggested classification is suitable for optimization of the working regimes for the devices of this type. The accomplished comparative evaluation of the examined variants can be used for working out methods for an effective defence for rectifier convertors.*

Keywords: *Power converters, Power Semiconductor, Digital complex, break – down process.*

MICROELECTRONIC NETWORKS ANALOGOUS TO PROTEIN HYDROGEN BONDED NETWORKS MADE FROM BACKBONE PEPTIDES AND WATER MOLECULES

Rostislav Rusev , Boris Atanasov, Tihomir Takov, Marin Hristov

Abstract: *For microelectronic purposes, signal transfer (proton transfer) in a hydrogen bonding network is studied. The network is extracted from β-lactamase and it includes atoms from protein backbone and water molecules. The model of proton transfer in hydrogen bonds is developed on the basis of Marcus theory and the protein electrostatic theory. The investigations show that the characteristics of hydrogen bonds are similar to V-A characteristics of single-electron transistor, semiconductor diode and current generator. The entire network is similar to a microelectronic circuit with two inputs and two outputs. In addition, it can be used for a signal transfer.*

Keywords: microelectronics, proton transfer, hydrogen bond, single-electron transistor

DEVELOPMENT AND ANALYSIS OF A SIGNAL TRANSFER CIRCUIT WITH HYDROGEN BONDING

Rostislav Rusev, George Angelov, Boris Atanasov, Tihomir Takov, Marin Hristov

Abstract: *A microelectronic circuit based on hydrogen bonds is developed and analyzed. The simulations in Matlab demonstrate that the biocircuit object emulates the functionality of conventional electrical circuits. The static analysis shows the circuit is akin to current source while the dynamic analysis demonstrates that the circuit successfully transfers and processes signals (with the option for signal decoding).*

Keywords: Hydrogen bonds, microelectronic circuits, bio-computing

APPLICATIONS OF HARDWARE DESCRIPTION LANGUAGES FOR FREQUENCY DOMAIN MODELING AND ANALYSIS OF ANALOG CIRCUITS

Ivan Panayotov

Abstract: In this paper the way of using universal Analog and Mixed Signal (AMS) Hardware Description Languages (HDLs) to model and simulate frequency dependant elements such as filters is discussed. Analog description languages such as VHDL-AMS and Verilog-AMS gain popularity as instruments for mixed signals modeling and simulations. They make it easy to model systems on high behavior level of description, to perform mixed-domain simulations and to design using modern system on chip approach. As standard languages in most their use, they allow more complex simulations to be made with universal HDL-AMS simulators and to use different abstraction levels for creating more or less detailed descriptions.

More professional CAD software tools such as CADENCE, SYNOPSYS, Mentor Graphics and others, provide HDL-AMS support in their design flow.

Keywords: VHDL-AMS, Verilog-A/AMS, Analog modeling, Simulations, Behavior descriptions, CADENCE, Mentor Graphics.

E-LEARNING WITH MOODLE IN THE ENERGETICS AND ELECTRONICS COLLEGE

Nadezhda Spasova

Abstract: *The aim of the current research is to share experience of the choice and introduction of an e-learning system in the Energetic and Electronics College, as well as considering features of the education - all curriculums are organized to have close relation between theory and practice. A choice of LMS is been made – platform Moodle.*

Moodle is a constantly developing project, based on the theory of socially constructional pedagogic. The first application is at the subject "Materials and components about the electronics". In relation to the introduction of the e-course the educational stuff is structured in separate topics. There have been developed practical exercises, methodic guidance for their solution and progress test.

This decision could be used as a prototype of a system, which could be developed in time.

Keywords: *e-learning, e-education in the Energetics and Electronics College, LMS, Moodle.*