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AN ENHANCED SIMULATION MACROMODEL FOR CURRENT-FEEDBACK AMPLIFIERS

Ivailo Milanov Pandiev

Abstract: *In this paper, an enhanced SPICE macromodel for Current-Feedback Amplifiers (CFA) is presented which takes into account the second-order effects such as the noise, the common-mode rejection ratio (CMRR), the positive and negative output voltage swing, and power-supply rejection ratio (PSRR) as a function of temperature. The simulation model is developed through modifying the basic macromodel employing the mechanism of controlled sources and subcircuits. Model parameters are extracted for the integrated CFA AD8001 as an example. The accuracy of the model is demonstrated by comparison between the data sheet parameters of the real IC and the simulation results.*

Keywords: analogue circuits, current-feedback amplifier, SPICE, Modelling.

DESIGN AND SIMULATION TESTING OF SELECTIVE LC-AMPLIFIERS WITH ACTIVE INDUCTORS

Ivailo Pandiev, Dimiter Stamenov, Lila Donevska

Abstract: *The present paper discusses the development of a specific type of selective LC amplifier with an active inductor and a current-feedback amplifier (CFA) with an additional port for control. The active inductor (gyrator) is built on the base of a general impedance converter (GIC), consisting of two op amps and RC-elements. The gyrator transforms the capacitance of the circuit to the emulated inductance. The main advantages of this new configuration are the insignificant influence of the load over the parameters of the amplifier and the possibility for independent tuning of the voltage gain and the Q -factor of the circuit. Some recommendations for designing this kind of analogue circuit are given, based on simulation results and symbol analysis of the transfer function. To confirm the validity of the design procedure, simulation results are compared with measurements of the electrical parameters in a practical LC amplifiers with small Q -factor and voltage gain, where a good agreement between simulations and measurements is found.*

Keywords: Analogue circuits, Selective LC-amplifiers, CFA, General impedance converter, Active inductor, Simulation.

PRACTICAL EXAMINATION OF RELATIONSHIPS BETWEEN DESIGN AND PERFORMANCE PARAMETERS OF CMOS AMPLIFIERS

Emil Dimitrov Manolov, Marin Hristov Hristov

Abstract: *The paper proposes a set of experiments with CMOS transistor array, which is a part of EDUCHIP test circuit. The goal of the experiments is to examine the dependence of the performance of CMOS amplifiers from bias current and W/L ratio of amplifying transistors. For that purpose different topologies of CMOS amplifying stages are presented and circuits for testing their basic small signal parameters and characteristics are discussed. Generalized tabular and graphical results from practical measurements are shown. They can be used in research and education on microelectronic circuits.*

Keywords: CMOS Analog Circuits, Design parameter, Performance parameter, Differential amplifier, Operational Transconductance Amplifier

DESIGN OF FPAA SINEWAVE OSCILLATOR BASED ON VAN DER PAUL EQUATION

Filip Todorov Koparanov, Emil Dimitrov Manolov, Mihail Hristov Tzanov

Abstract: *A Field Programmable Analog Array (FPAA) circuit of a low-frequency sinewave oscillator has been proposed and investigated in this paper. For that purpose the typical structure of a sinewave oscillator, based on the modeling of Van der Paul differential equation has been studied. Using the CAD system AnadigmDesigner2 the FPAA circuit of the oscillator has been designed and simulated. It has been practically implemented and experimented by means of Evaluation Board AN221E04 – a product of Anadigm Inc. The obtained results confirm the effectiveness of the proposed solution. The designed sinewave oscillator can be applied in research and educational practice in designing programmable SC circuits and FPAA based systems.*

Keywords: Field Programmable Analog Array, FPAA, Sinewave oscillator, Van der Paul equation, Switched capacitor, SC circuits

SIGMA-DELTA MODULATOR PROTOTYPING USING FPAA

Mihail Hristov Tzanov, Emil Dimitrov Manolov, Filip Todorov Koparanov

Abstract: *The paper presents the results from sigma-delta modulator prototyping. It briefly describes the classic structure of first and second order sigma-delta modulators. Three circuits of first order sigma-delta modulators and one circuit of a second order sigma-delta modulator were designed using Field Programmable Analog Array (FPAA). Their operation was examined in time domain at different constant input voltages and at sinewave input signal. The circuits were practically implemented and experimented by means of Evaluation Board AN221E04 – a product of Anadigm Inc. The obtained results confirm the effectiveness of the designed prototypes. The proposed sigma-delta modulators can be applied in research and educational practice for designing programmable SC circuits and FPAA-based systems.*

Keywords: Sigma-delta modulator, Field Programmable Analog Array (FPAA), Time-domain analysis, A/D and D/A converters, Switched capacitor, SC circuits

DESIGNING DSP ALGORITHM WITH THE VIRTEX-4 XTREMEDSP SLICE

Anna S. Kuncheva, Dimitar Nikolov, Marin Hristov

Abstract: *Finite impulse response (FIR) filter is the key functional block in DSP (Digital Signal Processing) designs and nearly always form the starting point for analyzing an architecture. This paper contains a new filter architecture, along with FPGA- Virtex-4 (Xilinx) and XtremeDSP (DSP48) slice. The XtremeDSP slice is a high performance multiplier and arithmetic unit with great flexibility that can form the building block of DSP algorithms implemented in FPGAs. Traditional adder-tree approach limited the performance and extensibility of given filter implementation. By using adder-chain style of implementation these limitations are lifted.*

A novel approach in both design and implementation of digital FIR filter using the DSP system element of Virtex-4 (Xilinx) architecture – XtremeDSP (DSP48) slice is presented. Embedded nature of the XtremeDSP slice has a radical impact on reducing the power consumed by high-speed multiply and add function.

Keywords: DSP, FIR, XtremeDSP(DSP48), FPGA

BEHAVIORAL MODELING AND SIMULATION OF SPIRAL INDUCTORS WITH ANSOFT SIMPLORER

Elissaveta Dimitrova Gadjeva, Vladislav Petrov Durev

Abstract: *A behavioral model of spiral inductor is developed in the present paper realized using the possibilities of the Ansoft Simplorer simulator. The basic possibilities and advantages of Ansoft Simplorer for behavioral modeling and simulation of electronic circuits are presented. An example is presented illustrating the modeling and simulation of spiral inductors. A comparison of the results with a corresponding PSpice model is given. The designed VHDL-AMS spiral inductor model is simple, algorithmic and realized to be easily implemented as a module in mixed signal simulation of large analog-digital projects.*

Keywords: *behavioral modeling, module design, algorithmic model*

PARAMETERIZED TOLERANCE MODELS OF SWITCHED-CAPACITOR CIRCUITS

Elissaveta Dimitrova Gadjeva, Zdravko Atanasov Garmev

Abstract: *In the present paper, parameterized models are developed for tolerance analysis of SC-circuits using standard PSpice-like circuit simulators. They allow the assessment of the design component tolerances using Monte Carlo and Worst Case analyses. The tolerance models of the capacitor and operational amplifier are based on multiphase models in the z-domain and are realized in the form of multiport subcircuits. The tolerances are defined as model parameters. The description of the models is given in correspondence with the input language of the PSpice simulator. The tolerance field due to the design element tolerances and the histograms of the output characteristics are obtained in the graphical analyzer Probe. The developed models are verified using test examples.*

Keywords: *tolerance analysis, parameterized PSpice models, SC-circuits*

MOSFET SIMULATION USING MATLAB IMPLEMENTATION OF THE EKV MODEL

George Vasilev Angelov, Katya Konstantinova Asparuhova

Abstract: *The paper presents an implementation of EKV MOST model in Matlab environment. Parameter extraction and fitting procedures are briefly sketched. Open source modules for transistor characteristics and additional functions for parameter extraction and fitting are included in a Matlab toolbox. Model parameters are user defined to provide flexibility of design process. The accuracy of simulation results is ensured by using Labert's W interpolation function in the single expression for the drain current. Validation against conventional BSIM3v3 model for a $0.35 \mu\text{m}$ CMOS technology is performed.*

Keywords: *MOS transistor, open source model, EKV model, Matlab.*

FIFTH-ORDER LOWPASS SC LADDER FILTER WITH REDUCED SENSITIVITY TO OPERATIONAL AMPLIFIERS FINITE GAIN AND OFFSET VOLTAGE

Nikolay Radev, Kantcho Ivanov

Abstract: *A combined approach for reducing the effects of operational amplifiers finite DC gain and offset voltage in fifth-order lowpass SC ladder filter is proposed. The filter with gain- and offset-compensated integrators and modified capacitance values yields significant improvement in the passband response.*

ANALYSIS OF TWO NEW APPROACHES FOR NOISE REDUCTION IN US IMAGES

Veska Georgieva

Abstract: *In the paper was presented a comparative analysis of two new approaches for specific noise reduction in medical ultrasound (US) images on the base of 2D Discrete Wavelet and Wavelet Packet Transformations. Some parameters of the wavelet transformations are optimized with the goal to become maximal noise reduction and improve the quality of the diagnostic ultrasound images. They are taken into account by the analysis of two different approaches. Some results of the experiments are presented, which were made by computer simulation in MATLAB environment.*

IMPLEMENTATION OF AN IGBT BEHAVIORAL MODEL IN MATLAB/SIMULINK

Katya Asparuhova, Tsvetana Grigorova, Snegana Terzieva

Abstract: *The paper presents implementation of an IGBT behavioral model in MATLAB/Simulink. The model is built using the configuration of the Hammerstein model consisting of a nonlinear static block followed by a linear dynamic block. The nonlinear DC equations and correction functions are precisely represented and the parameters of the dynamic part are extracted and optimized using wide computational possibilities of the MATLAB package, which is resulting in a good accuracy. The required parameters setup in the model is shown too. This is easy for the users and makes the model applicable for different type of IGBTs using data sheets and simple measurements or simulation results. The results are compared with the simulations of the same model, implemented in PSpice simulator.*

DESIGN AND ANALYSIS OF SYMMETRICAL SPIRAL INDUCTORS FOR RFIC

Ivan V. Petkov, Diana I. Pukneva, Marin H. Hristov

Abstract: *In this paper are discussed symmetrical inductors. They have significant advantages over classical 2-port inductors in silicon-based RFIC, e.g. higher Q factor, higher self-resonant frequency, and smaller inductor size. 2-port classic and 3-port symmetrical inductors with different electrical parameters and sizes are simulated and compared.*

Keywords: Symmetrical spiral inductors, RF, analysis, design

ELECTROCHEMICAL FORMATION OF THREE-DIMENSIONAL GOLDEN MICROCONTACTS

Nikola Yordanov, Svetozar Andreev, Filipina Ivanova, Radosvet Arnaudov

Abstract: *Electroplating of golden layers is often used in the microelectronic devices. This paper reports our experimental results from formation of golden micro - contact elements – bumps with diameter 300 μ m, developed by UV-LIGA process. The gold-acid-cyanide electrolyte, which is used, has no influence on the dry negative photo-resist (PR). We investigate different electroplating regimes – direct current and impulse-current regimes, the uniformity of micro - contact elements (MCE) growth over the matrix surface and the kind of bumps' surface.*

Keywords: electroplating, bumps, flip-chip, gold

EFFICIENCY INVESTIGATION OF BUCK DC-DC CONVERTER FOR RF APPLICATIONS

Tihomir Sashev Brusev, Petar Trifonov Goranov, Marin Hristov Hristov, Rosen Nikolaev Slavov

Abstract: *This paper was focused over the efficiency evaluation and optimization of switch-mode dc-dc converter for RF applications. AMS CMOS 0.35 μ m technology was used for investigations. Effect of different factors over the circuit's behavior was considerate. Soft-switching control techniques was analyzed and compared with basic regulation's method of buck converter. Influence of current-mode of operation was explored. Efficiency of about 76 % at 400 MHz switching frequency is illustrated for voltage conversion from 3.6 V to 1.2 V.*

Keywords: dc-dc converter, fully monolithic design, efficiency, CMOS 0.35 μ m technology

CAPACITORS DC-DC CONVERTERS FOR RF IMPLEMENTATION

Tihomir Sashev Brusev, Petar Trifonov Goranov, Marin Hristov Hristov

Abstract: *Two separate capacitor's dc-dc converters for RF implementation are analyzed. The goal of this work is to be skipped the negative effects of the integrated inductors, which can destroy the circuit's parameters. Simulations results demonstrated in this paper were done with AMS CMOS 0.35 μ m process. Presented architectures are suitable for low power applications. Silicon area can be saved by use of the investigated capacitor's dc-dc converter and fully monolithic design is possible to be realized.*

Keywords: monolithic dc-dc converter, CMOS 0.35 μ m technology, efficiency

CMOS VCO DESIGN

Marin Hristov Hristov, Ivan Krasimirov Rashev, Dobromir Nikolov Arabadzhiev

Abstract: *In this article, the design of quadrature voltage controlled oscillator (Q-VCO), which covers the Bluetooth requirements is described. A methodology which makes easy the design of oscillators with negative resistance is shown. Standard 0.35 μ m CMOS process was used. The circuit is fully monolithic, and this decreases its price. The oscillator has output buffers, which ensure the necessary power of the output signal. The supply voltage is 1,5 volts and is limited by the used technology and the parameters necessary for the normal work of the oscillator. The overall power consumption of the oscillator and the output buffers is 107 mW, and the phase noise is -108dBc/Hz, at 600 kHz from the carrier.*

Keywords: QVCO, negative resistance, Bluetooth, CMOS technology

CLASS E POWER AMPLIFIER FOR BLUETOOTH APPLICATIONS

Olga Antonova, George Angelov, Valentin Draganov

Abstract: *The main purpose of this paper is to present the design of a class E power amplifier for Bluetooth Class 1 application. The power amplifier has to provide 20 dBm output power and as high as possible power efficiency at 1.5V power supply voltage, for 0.35 μ m CMOS Austria Microsystems (AMS) technology.*

Keywords: Class-E, CMOS, monolithic inductors, power amplifier

INVESTIGATION OF THE EFFECTIVE THERMAL CONDUCTIVITY OF PCB

Anna Andonova, Nadja Kafadarova, Galin Pavlov

Abstract: *The investigation deals with the numerical solution of the 3D heat conduction equation and study variation of the effective conductivity of PCB with different component size. Cases with and without a copper layer on the component side and different PCB thicknesses were investigated. It was shown that the effective thermal conductivity of a PCB with/without a copper layer on the component side would be larger/smaller than the values given by the one-dimensional effective thermal conductivity model if the components mounted on the PCB were smaller than the PCB itself. The difference was more pronounced for smaller components. Correlations were obtained for the effective thermal conductivity of PCBs.*

Keywords: PCB, CFD, Thermal conductivity

IONIZATION CHAMBER BASED ON RF SPUTTERED ITO THIN FILMS

Stefan Ivanov Boiadjiev, Boris Marinov Marinov*, Georgi Hristov Dobrikov, Milka Markova Minkova Rassoavska, Rumen Stoyanov Yordanov

Abstract: *The present work presents a new type ionization chambers for x-ray dose meters, based on indium-tin oxide (ITO) thin films. ITO attract our attention as promising material with various applications, here in our study as a transparent conducting coating, but also for transparent conductive electrodes in displays, solar cells and many other applications, where transparent electrodes are needed.*

The films microstructure has been studied by TEM and SAED using TEM-400, Philips transmission electron microscope. VIS – UV spectrophotometry analysis showed the high visible transmittance of the RF sputtered ITO films. The dependence of voltage signal from the ionization dose has also been studied.

The main goal of the research activities is developing new technological processes leading to low-cost, highly effective optical coatings for application in ionization chambers.

Keywords: ionization chamber, ITO, RF sputtering, thin films

PRODUCTION OF 3D CONTACT STRUCTURES USING THE LIGA METHOD

Valentin Videkov, Evelina Aleksandrova Mihaylova, Svetozar Krastev Andreev, Nikola Stefanov Iordanov

Abstract: *The purpose of this report is finding an alternative method for 3D contact structures production, which is different from traditional silicon technology. The LIGA method showed capability of preparing such structures. For that purpose the technological sequence for LIGA process implementation in making of functional contact is investigated and improved. In order to make the contact commutate the circuit without human taking part in the process the bimetal effect is used. The test cantilever beams are made of two materials with different coefficients of linear expansion. For that reason when temperature rises the beam leans towards the material with lower coefficient and that makes commutation possible. In this paper the technological sequence for preparing such bimetal structures and results from experiments for checking their functionality are given.*

Keywords: 3D contact structures, LIGA method, bimetal effect

THREE-DIMENSIONAL MICROFABRICATION OF HIGH-ASPECT-RATIO STRUCTURES USING DRY NEGATIVE PHOTORESIST

Svetozar Krastev Andreev, Adriana Kirilova Georgieva, Svetlin Stefanov Todorov

Abstract: *The development of anisotropic, high-aspect-ratio micromachining processes has provided opportunity for the extension of silicon microfabrication capability well into the third dimension. For some applications, however, truly 3D structures are desired, especially those that possess arbitrary surface height profiles, i.e., surfaces with multiple height levels and/or nonplanar profiles.*

The present paper presents results from the fabrication of 3D microcontact structures using LIGA process. It is known that this process is used in micromechanics for constructing 3D structures for a long time using roentgen as well as UV photolithography. This material suggests technological order and realization of 3D microcontacts using many-stages photolithography of dry photoresist.

Keywords: LIGA, microcontacts, dry photoresist, micromechanics, photolithography

WAVE SOLDERING QUALITY IMPROVEMENT BY DESIGN OF EXPERIMENT APPROACH

Anna Andonova, Nely Dinkova, Ivan Marinov

Abstract: *The investigation deals with quality improvement of wave soldering joints for printed circuit boards (PCB) by using DOE approach. Using DOE pro XL capabilities, DOE and statistic process control an effective way to approach and evaluate wave soldering process development is offered to determine the most essential control parameters in order to achieve the optimum process set-up for individual application. An example was given to show the procedure and results in using our investigations. The goal in the presented experiment was to reduce greatly the solder connection defects as bridges and poor soldering elements.*

Keywords: Wave soldering process, Design of Experiment, Optimization

TWO-DIMENSIONAL PHYSICAL AC-SIMULATION OF GAAS HBTS

Vassil Palankovski, Marin Hristov, Philipp Philippov

Abstract: *In this work, results from fully two-dimensional physical device simulation of Gallium Arsenide (GaAs) heterostructure bipolar transistors (HBTs) are presented. Scattering parameters (S-parameters) are directly obtained from small-signal AC-analysis of real devices. A comparison reveals very good agreement with measured data.*

Keywords: GaAs HBTs, physical modeling, device simulation

REITERATED MICRO CONTACTS

Valentin Videkov

Abstract: *In the present report some micro contacts designs of "dry" type where processes of welding and soldering are not applied are considered. The peculiarities of mechanical contact realization for different structures are discussed. They have been divided into groups according to the plane of the devices. Photos of experimentally made structures and some parameters are submitted. The basic technological circuits for LIGA process are shown. The advantages and drawbacks of separate designs and ways for further researches are discussed.*

RESPONSE OF A NAI(TL) SCINTILLATION DETECTOR IN A WIDE TEMPERATURE INTERVAL

Ludmil Todorov Tsankov, Mityo Georgiev Mitev

Abstract: *The temperature dependence of a NaI(Tl) scintillation detector's response has been studied in the temperature interval (-300C to +500C). Besides the common temperature drift of the light output and that of the decay time of the scintillator, some other very-long-term factors have been observed which give rise to a remarkable hysteresis of the output signal drift. They are most probably due to the PMT temperature instability. A post-processing method is proposed to compensate their effect and the results of its application are discussed.*

Keywords: Scintillation detectors, long-term behaviour

ELECTRICAL DESIGN OF SINGLE-PHASE DIODE RECTIFIERS WITH ACTIVE-CAPACITIVE LOAD BY MATLAB

Evgeniy Ivanov Popov, Liliya Ivanova Pindeva

Abstract: *Single-phase diode rectifiers with active-capacitive load widely applied in different supplying sources pose specific problems to the engineers. The known methods ('eastern', based on the assumption that the voltage across the filtering capacitor is almost even and 'western') for their electrical design are graphic-analytical and suffer from limited accuracy and waste of time. Some quantities, namely the r.m.s. values of the transformer secondary and primary winding currents, are specified. The standard transformer power, the powers of its windings, the output (load) characteristic and the distortion coefficient of the primary current are also obtained. MATLAB programs for exact graphical representation of the functions, participating in the full electrical design of the rectifiers and for computer-aided design implementation are created. PSPICE simulations confirm the results for some practical examples.*

Keywords: MATLAB design, single-phase, diode rectifiers, capacitive load.

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

Vladislav Danchev Veselinov

Abstract: *The present article consider the possibilities of optimization of the control processes on the basis of Digital Parametric Complex. Its main functional centre is presented as a part of conditions for reliability of the analysis of different break-down processes. A summery is made about the influence of the system of control upon the security of work of the power electronic device. The realized by the complex methods for estimation of the qualitative parameters and the suggested algorithms could be used as basis for working out devices of this type.*

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

ECONOMICS REASONS TO USE SHUNT ACTIVE POWER FILTERS

Mihail Hristov Antchev, Ahmed Fahem Zobaa, Mariya Petkova Petkova

Abstract: *The economics reasons to use shunt active power filters are considered from the point of view of the consumer and producer of electrical power. 3-D diagrams, that give the relationship between load parameters and saving for the consumer and producer of electrical power, are carried out. Experimental results with an estimated saving are given.*

Keywords: active power filter, economics benefit.

COMPUTER SIMULATION OF SERIES ACTIVE POWER FILTER

Mariya Petkova Petkova, Mihail Hristov Antchev, Vanjo Tomov Gurgulicov

Abstract: *The possibility of hysteresis following of a reference sinusoid to control series active power filters as correctors of quality of consumed power from supply network is shown in this paper. This possibility is described using computer simulation.*

Keywords: series active power filters, hysteresis control.

POWER ELECTRONIC DEVICES FOR WIND TURBINES

Krusteva Anastassia, Marinov Tsvetan, Hinov Nikolay

Abstract: *During the last two decades, the production of wind turbines has grown in size from 20 kW to 2 MW. The electrical part of a wind turbine is becoming more and more important and, it is very important to have this system highly integrated into the overall wind turbine design.*

Electrical developments include the use of advanced power electronics in the wind generator system design, introducing a new control concept, namely variable speed. Due to the rapid development of power electronics, offering both higher power handling capability and lower price/kW, the application of power electronics in wind turbines will increase further. Another interesting issue is the efforts, which have been put into research and development of new motor/generator concepts for some years.

The following presentation will look deeper into old and new concepts of generators and power electronics.

Keywords: Power electronics, Wind turbines, Renewable energy sources

DEBUGGING AND DIAGNOSTIC OF SENSORS CONNECTED IN A NETWORK USING MICROCONTROLLER MSP430

Georgi Dotsov Geshev, Emil Nikolov Dimitrov

Abstract: *In this paper is examined monitor program for debugging, adjustment and diagnostic of embedded microprocessor system based on TEXAS Instruments MSP430. It is foreseen to work with it while the separate systems are connected to a local network. After a review of the existing monitor programs and analysis of the available resources in the microcontroller family, functions are selected to be implemented into this service program. Some specifics and constraints are mentioned.*

Keywords: Embedded system, microcontroller, monitor program

SYSTEM FOR ADJUSTMENT AND TEST OF ALGORITHMS FOR ECG-DATA PROCESSING

Ivo Tsvetanov Iliev, Serafim Dimitrov Tabakov

Abstract: *The paper presents a high-performance system for adjustment and test of algorithms for data processing, embedded in real ECG devices. An additional advantage of the system is the possibility for simultaneous visualization of the applied test signal and the result after processing. This may be a beneficial tool and considerable reduce the difficulties in design and debugging of software methods for ECG analysis.*

Keywords: ECG simulator, ECG signal, ECG-data processing

REAL-TIME DETECTION OF ACCIDENTAL PATHOLOGIC CARDIAC EVENTS IN THE ELECTROCARDIOGRAM

Ivo Tsvetanov Iliev, Vessela Tzvetanova Krasteva, Serafim Dimitrov Tabakov

Abstract: *The major efforts for improving the automated cardiac diagnostics are directed towards developments of innovative hardware and software solutions for computer-assisted electrocardiogram (ECG) monitoring systems. The presented work describes a method for fast detection of pathologic cardiac events by real-time ECG analysis. It is convenient for embedding in microcontroller-based autonomous system for monitoring of high-risk cardiac patients. The algorithm involved on-line operating procedures, including preprocessing filtration, threshold-based QRS detection, interbeat RR-intervals analysis and QRS pattern waveform analysis. Aiming at a simple solution, we adopted specific strategies for signal processing acceleration and for reduction of the operational memory size, such as the resolution reduction of the QRS pattern waveform. Moreover we implemented simplified techniques for rating of the similarity between the QRS pattern of the tested beat and the accumulated QRS pattern of the preceding heartbeats. The repetition of similar QRS pattern waveforms combined with small variances of the RR-intervals, was interpreted as a normal rhythm. However, the appearance of a number of deviations either from the mean RR interval, or from the cumulative QRS pattern waveform, was detected as a sustained pathologic event. The developed algorithm was implemented in Matlab environment. It was tested with internationally recognized ECG databases. Several examples are presented and discussed.*

Keywords: ECG monitoring, high-risk cardiac patients, real-time ECG analysis