Foreword and Editorial

International Journal of Control and Automation

We are very happy to publish this issue of an International Journal of Control and Automation by Science and Engineering Research Support Society.

This issue contains 39 articles. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the Editorial Board members and External Reviewers. We take this opportunity to thank them for their great support and cooperation.

The paper “Generation of Odd-Periodic Sequences of Even Length for Optimal Frame Synchronization” states that synchronization sequences with special correlation properties can be inserted into a bit stream to correlate the timing at the transmitter and the receiver. On the basis of the ideal auto-correlation property of sequences with an odd length, a new method of constructing odd-periodic sequences of even length is proposed. The auto-correlation of a sequence has double maximum values equal in magnitude and opposite in polarity at zero and middle shifts with the lowest out-of-phase values excluding those at the middle shift. Such sequences are particularly useful for frame synchronization, since the special correlation property can be used to double-check the synchronization timing.

In the paper “Development of PCR Control Software for Smartphone Using both Wired and Wireless Communications”, the polymerase chain reaction (PCR) is a detection method used in almost all the experimental processes that involve manipulation of the current genetic materials to amplify the specific target genetic material to be preferably detected. The recent PCR thermal cycler has adopted a general-purpose computing platform in which specific operation systems run in a computing device to support the GUI. In this paper, Smartphone PCR control software, including the GUI, which can be run on not only Bluetooth, but also USB Communications, is proposed. The GUI is implemented in Android platform, and the connection to the PCR device uses a standard interface USB and Bluetooth to minimize the dependence on the platform.

Paper “Modeling and Analysis of Normal Contact Stiffness of Machined Joint Surfaces” presents the mechanical joints normal contact stiffness model based on fractal geometry and contact mechanics theory. The joint normal dimensionless contact load and dimensionless contact stiffness relationship are analyzed in different fractal dimensions and materials.

The paper “Reducing the Number of UVB Lamps for Low-cost Gel Imaging System Implementation” presents a low-cost method of constructing a UV illuminator, which is considered an important component of a gel documentation system. The procedure involves using a smallest-possible UV lamp in the UV illuminator instead of conventional 4 UV lamps.

Paper “Research in Turn-on Delay of Semiconductor Lasers” derived out a closed expression describing the time evolution of the carrier density within the turn-on period of a semiconductor laser, for the case that the Auger effect is considered with a term which is proportional to the cube of the carrier density.
The paper “Further-inspection for Doubly-Fed Converter: Theory, Method and Experimental Platform” states that in recent years, the interest in the use of regenerative energies has increased considerably, which helped to alleviate the energy crisis and to protect the environment. However, the over-rapid development of wind power also leads to some problems in China, for example, several large-scale off-grid accidents caused by quality problems of wind turbines. Since converter is a core component of wind power turbine, improving converter control strategy can prevent such accidents. Therefore, this paper explores and analyzes the converter control strategy and its influences on power grid and wind turbines, including grid power and voltage fluctuation, small signal stability, transient stability, LVRT (low voltage ride through), shaft damping, and shaft transient stress. This paper attempts to determine the content and method for quality inspection of converter and proposes a test platform to carry out flexible, efficient and reliable quality test.

The paper “Recursive Solution of Position Determination Problem using Time Difference of Arrival Method” discusses that recently, the time difference of arrival (TDOA) based position determination technique is broadly used in many kinds of real time locating systems. In contrast with other position determination methods, TDOA based localization technique has the strength that it is unnecessary to synchronize the time between each receivers. In this paper, in order to compensate measurement error due to time delay of signal propagation, the recursive least square (RLS) method is used. The RLS method is an iterated technique of least square (LS) method. The accuracy and calculation speed of estimated solution are improved through this algorithm.

In the paper “Research on the Control Strategy of Passive Torque Servo System for Loading at High Frequency”, in view of the problem of difficult to suppress surplus torque and to obtain high servo accuracy at high frequency in the passive torque servo system (PTSS), the neural network PID control strategy with surplus torque compensation based on dynamic fuzzy neural network (DFNN) and double-stator motor is proposed. Firstly the model of the PTSS is built and the mathematical model of surplus torque is derived. Then the model of surplus torque is identified by DFNN. The surplus torque is estimated in real time and converted directly to the control signals of outer stator of double-stator motor which produces torque to compensate the surplus torque. Finally the parameters of the neural network PID (NNPID) controller are adjusted in real time according to the Jacobian information and system error. The Jacobian information is obtained from the online identification of PTSS by RBF neural network.

The paper “The Development of a Model for Measurement of a Clinical Information System for the Prevention of Osteoarthritis” is focused on the development of a model for measurement of a clinical information system for the prevention of osteoarthritis. The subjects of this paper were 106 patients who had been visited a general hospital which located in Chungnam area.

The Authors of “Minimization of Power Loss and Voltage Deviation by SVC Placement Using GA” discusses that modern restructured power systems sometimes operate with heavily loaded lines resulting in power system to work under condition of higher power loss and higher voltage deviation, which may result in insecure operation of power system; even sometimes it may lead to voltage instability or system collapse. It is mainly due to continuous and uncertain growth and demand of electrical power. This paper presents a methodology to
solve a multi-objective optimization problem to find optimal location and size of Static VAR Compensator (SVC); in order to minimize real power loss (RPL) & load bus voltage deviation (VD) and also enhancing voltage security using Continuous Genetic Algorithm (CGA). The effectiveness of the proposed method is demonstrated on a standard IEEE 30-bus system.

In the paper “Reinforcement Learning Fuzzy Neural Network Control for Magnetic Shape Memory Alloy Actuator”, magnetic shape memory alloy actuator is a new type of actuator that can offer big travel and high resolution of output displacement, which makes it suitable for driving task. However, its output displacement represents the hysteresis applied to input magnetic field. Hysteresis restricts its application in the high precision positioning. In order to eliminate the hysteresis of magnetic shape memory alloy actuator, a reinforcement learning fuzzy neural network controller is proposed. Network structure and special learning algorithm of reinforcement learning fuzzy neural network controller are introduced in detail. The proposed control system adopts the generalized approximate reasoning-based intelligent control architecture, which is mainly consisted of three parts: Action Selection Network, Action Evaluation Network and Stochastic Action Modifier.

The paper “Improving Packet Delivery Efficiency Using Dual 3GPP LTE Communication Modules for Railroad Wireless Communication” states that as a next generation of Global System for Mobile Communications – Railway (GSM-R), 3rd Generation Partnership Program (3GPP) Long Term Evolution (LTE)/ LTE-Advanced (LTE-A) is considered for railroad wireless communication, i.e., LTE-Railway (LTE-R). In this paper, by exploiting the unique characteristic of railroad wireless communication, an improved packet delivery scheme using dual communication modules for railroad wireless communication is proposed. By using the proposed scheme, almost zero service interruption time during handover can be achieved. Since the protocol architecture of the proposed scheme utilizes the current LTE railroad wireless communication hardware, the proposed scheme can be utilized with minimum modification.

In the paper “Study on Self-tuning Control Strategy of Suspension Systems for Improving Vehicle Ride Performance”, a new control theory based on fuzzy-logic will be proposed for the purpose of enhancing vehicle ride performance. In the first step, a half car model with four DOF will be analyzed by Lagrange equations after which a conventional semi-active skyhook controller will be built. Then a new control model that considering vehicle mass as well as vehicle speed will be provided, the advantage of this controller will be studied. Harmonic excitation and Random excitation will be given as road input.

In the paper “Multi-input Multi-output Semi-active Fuzzy Control of Seismic-excited Building with Evolutionary Optimization Algorithms”, a multi-input multi-output (MIMO) semi-active fuzzy control algorithm has been developed for vibration control of a seismically excited building structure. The MIMO fuzzy controller was optimized by evolutionary genetic algorithm. For numerical simulation, a five-story example building structure is used and two MR dampers are employed as semi-active control devices.

The Authors of “A Preliminary Study on Energy Saving Smart Space Using Location Awareness Technology” discusses that as the issue of conserving energy is a major current global issue, concerns and efforts from all circles are required. With such a background, technology realizing Smart Space utilizing IT technology is recently drawing attention as an
effective method of reducing building energy consumption. This study investigates Smart Control System to collect the fundamental materials necessary to realize Smart Space and suggests Smart Lighting Control System, with better efficiency and performance than the existing lighting control system.

The paper “Power Estimation for Alpha 21264 Using Performance Events and Impact of Ambient Temperature” states that higher power has become one of primary obstacles for improving the performance of processors. To manage the power of processor dynamically, it is necessary to obtain the power timely and accurately. Power estimation using performance events is a better way in terms of timeliness and accuracy. Authors analyzed the correlation between performance events and powers of microprocessors. Only one performance event was selected for the power estimation of one functional unit based on the correlation analysis. The power of each functional unit was estimated based on simple regression analysis.

Paper “Performance Evaluation of Flash Translation Layer Considering Utilization and Dynamic Over-provisioning” states that the flash translation layer (FTL) is a firmware embedded in NAND-based block devices. It hides unique characteristics of NAND flash memory and emulates a standard block device interface. The overall performance of NAND-based block devices is mainly determined by the efficiency of the FTL schemes, and thus, it is important to evaluate the FTL performance to design high-speed NAND-based block devices, which is a main objective of this work.

The paper “Design and Implementation of 1-D and 2-D Mixed Architecture FFT Processor in Heterogeneous Multi-core SoC based on FPGA” proposes a novel architecture FFT processor which can carry on 1-D FFT algorithm or 2-D FFT algorithm corresponding different size of FFT. The architecture is served as a scalable IP Core which is suitable for the heterogeneous multi-core SoC on chip application. The mixed architecture FFT processor achieves balance between high processing speed and resources.

The paper “High-Efficiency AC-DC Switch-Mode Power Supply Using Full-Bridge Converter Circuits” presents a high-efficiency AC-DC switch-mode power supply (SMPS) using the full-bridge converter circuits. The proposed converter utilizes three full-bridge converter circuits: two full-bridge diode converter circuits and one full-bridge MOSFET converter circuit. The two full-bridge converters are utilized at the primary AC input and the secondary DC output, respectively, and the full-bridge MOSFET converter is used to convert a DC voltage to a high-frequency AC voltage that is converted to another DC voltage with the transformer and the secondary full-bridge diode converter, which is simply referred to as the full-bridge DC-DC converter.

The paper “The Method of dealing with Geomagnetic Anomaly caused by Movable Magnetic Objects in Drawing the Geomagnetic Chart” states that the local geomagnetic chart is an effective tool to describe the geomagnetic information in the region accurately and visually which is a reference in application for future. Precision of local geomagnetic chart directly affects its value. When the movable magnetic objects are in the region, the distribution of geomagnetic field will be changed. When the movable magnetic objects are out the region, the distribution of geomagnetic field will recover to normal situation. Thus, magnetic objects can bring the error to some measured data.
Paper “Semi-supervised Learning for Automatic Image Annotation Based on Bayesian Framework” presents a new method for automatic image annotation by applying semi-supervised learning based on the Bayesian framework. On the one hand, we employ the semi-supervised learning, i.e., transductive support vector machine (TSVM) to enhance the quality of training image data, which is a promising way to find out the underlying relevant data from the unlabeled ones. On the other hand, a simple yet very efficient Bayesian model is built to implement image annotation by the maximum a posteriori (MAP) criterion.

The paper “A Coherent Noise Control Using Templates” presents a noise control algorithm that produces temporally coherent artistic styles on movie files. The algorithm is devised using a template to preserve the temporal coherence of the artistic effects produced on the frames composing a video. In the first step, Authors produce a set of triangular meshes embedding the contents of a frame. Then, they generate noise in the coordinate system defined by the templates. And finally apply a texture coverage scheme to preserve the coherence of the noise distribution inside the templates. For the noise outside the templates, they propose local recursive filters that interpolate the noise between frames.

The Paper “Enhance Performance of Content Delivery Network Using Provider Oriented Hierarchical Corporative Proposal” states that the Content Delivery Network (CDN) has become increasingly popular over the past decade with the expectation to provide a better performance and a more scalable, reliable and available content delivery. This can be achieved by delivering the content from caches which are located closer to the end-users than the original server. However, the performance of CDN system is affected by the collaboration among CDN servers. This paper proposes a collaborative caching among CDN servers known as provider oriented hierarchical cooperative content outsourcing (POHC). To highlight the advantages of this propose, a mathematic analytical model is given to compare with the non-cooperative pull-based content outsourcing (Non-CPB).

Paper “Research and Implementation of Feature Points Detection of Automobile Headlights” discusses that in order to meet the increase of vehicle detection items and detailed testing contents, the detection methods of automobile headlight feature points were studied. The classification ways of automobile headlights were described and a detection system of headlight feature points was designed and realized by using digital image processing technologies according to the characteristics of headlight shapes. The front end image of automobile was analyzed, the front license plate was located precisely, the headlight detection areas were pre-located, and the headlight feature points were extracted based on modified Hough transform.

The paper “A Novel Hybrid Anti-islanding Detection Method for Three-phase Grid Connected Utility Interactive Inverter of a PMSG-based Wind Power Generation” states that islanding in a grid connected inverter of wind power generation system may give a bad effect on equipment or yield safety hazards on grid so it should be detected rapidly and exactly. Passive methods are simple to detect islanding by monitoring parameters of system but it has non detection zone (NDZ). Active methods are more effective to detect islanding by injecting small disturbance into output of utility interactive inverter. This paper proposes a novel hybrid anti-islanding detection method, which combines the conventional passive over/under voltage and over/under frequency (OUV-OUF) method with a new active harmonic injection method. In the proposed scheme, the active methods can be used effectively to overcome the
problem caused by the NDZ. When NDZ does not exist, the passive methods can detect the islanding rapidly.

In the paper of “A Conflict Diagnosis Approach of Changing Sequences in Gene Ontology Evolution”, the goal of the Gene Ontology is to provide a controlled vocabulary that can be applied to all organisms, even as knowledge of gene and protein roles in cells is accumulating and changing. Further, in the process of co-evolution, conflicts are unavoidable among ontology changing sequences.

The paper “Active Disturbance Rejection Control of Shell Gasifier in IGCC Power Plants” states that a unique control strategy based on Active Disturbance Rejection Control (ADRC) is introduced to the Shell gasifier control system. Firstly, the gasifier control system structure is illustrated based on the analysis of gasifier process dynamics and its control targets. Then a decentralized ADRC-based gasifier control system is designed and the controller parameter tuning procedure is given. The interaction of control loops, the uncertainties in the plant and the ignored dynamics in modeling process are all regarded as the general disturbance, which can be estimated by Extended State Observer (ESO) and then actively compensated in real time.

Paper “Shift Process Analysis of AMT without Synchronizer Based on Three-phase Induction Motor” states that in order to achieve synchronous shift on heavy-duty AMT (Automated Mechanical Transmission) without synchronizer, shift process analysis based on three-phase induction motor is proposed in the paper. On the basis of analysis for the speed loss of the transmission output shaft during shift process, the synchronous shift control strategy for AMT without synchronizer driven by three-phase induction motor is put forward for both upshift and downshift program.

The paper “Research on Aspect J Capturing Information of Boolean or Compound Expression-based and Process-Control Join points” presents a discussion that as to the research on AspectJ in this context, after analyzing the Java program, AspectJ can realize the capture of the join points based on the Boolean or Compound expression and Process-Control in the Java program. The information includes: the time to judge the runtime condition of each join point as “true”; use of the logic AND (&&) to combine pointcuts; and use of the logic OR (||) to combine pointcuts; declaration of anonymous pointcut and reuse of pointcut; It also includes all join points from beginning in program control-flow and those in which initial one is not included.

The paper “A DSP-based Robust Position Controller of a Single-sided Linear Induction Motor for Automatic Picking System” presents a DSP-based robust position controller design using an integral sliding mode control (SMC) scheme for application of a single-sided linear induction motor (LIM) to an automatic picking system (APS). To operate a movable ejector in the APS with high precision and high dynamics, a high performance linear motor drive system is required. The force disturbance as well as the mechanical parameter variations such as the mass and friction coefficient influence directly on the position control performance of APS. To guarantee a robust control performance in the presence of such uncertainty, an integral SMC-based position controller is considered. A Simulink library is developed for the LIM dynamic model.
The Authors of “Design of a Magnetic Field Generator for Compression Plasma Discharge Channel of Micro EDM Deposition” designed a magnetic field generator for compression plasma discharge channel of micro EDM deposition. The self-magnetic field type by discharge current in the plasma channel of micro EDM deposition process has been analyzed. It presents a stable gradient annular magnetic field with the variables of discharge current and the distance from the discharge center. The force analysis of the charged particles in the discharge plasma channel under the self-magnetic field has been researched. The design principles of external magnetic field for enhancing the self-magnetic field to influence the machining performance have been put forward. Then, the structure type and dimension of external magnetic field generator have been determined.

Paper “A Synchronous Optimization of Magnitude and Placement of Multiple Clamping Forces for Fixture Design” states that in order to resist external loads, multiple clamping forces will be produced to a workpiece so that its correct position can be immobilized during the entire machining operation. However, insufficient clamping forces cannot prevent the workpiece from motions whereas excessive clamping forces may cause the improper deformations of workpiece-fixture system. Therefore, a novel approach to clamping force determination is proposed for fixture design. Firstly, the measure method of magnitudes and placements of clamping forces is established from the various measure spaces to the uniform measure space for the first time. Secondly, a synchronous optimal model of magnitudes and placements of clamping forces is formulated as nonlinear constrained equations according to the minimum total complementary energy principle.

The paper “Sensing Compensation for an Activity Monitor” states that one of the most popular types of personal health device is the activity monitor, which is attached to the user’s wrist or waist in order to measure physical activity data such as exercise time/duration and calorie consumption. Given that it has an activity sensor and a gyro sensor to measure the speed of a user’s movement, an activity monitor can also be used to track the movement of sporting equipment. In this paper, in order to overcome the limitations of the sensor, the peak acceleration of the fast-moving sporting equipment is estimated using the interpolation method based on the acceleration values of the rest of the movement.

In the paper “Combinational Circuit Design Based on Quantum-Dot Cellular Automata”, quantum-dot cellular automata (QCA) provide a new approach in computer circuit design and development at nanotechnology level. This technology promises extraordinary high computing speeds, low heat dissipation and highly dense circuits. In this paper, two 2:4 decoders are proposed. The proposed structures reduce the clock phases to only three phases making them faster than the designs currently available in literature. The first proposed structure has reduced number of cells and hence covers a small area. The second proposed method although it has more cells, has regular clock zones that can facilitate the implementation of this circuit.

In the paper “A Parallelized Implementation for H.264 Real-time Encoding Scheme”, a high-speed video stream encoder for the H.264 digital video codec standard specification is accelerated with nowadays parallel processing architectures. Based on the parallel processing techniques with GPU’s, Authors used an OpenCL-based GPU kernel programs, and finally achieved a high-level CPU-GPU interoperability. In its design, the system makes the CPU perform all input/output operations and overall stream control, while GPU does the core encoding operations.
The Authors of “A Cost Effective Digital Signal Controller based Maximum Power Tracking Technique for Photovoltaic Power System” aims at developing a simple, efficient and cost effective maximum power point tracking (MPPT) system that can be employed for stand-alone Photovoltaic (PV) applications. The power versus voltage characteristics curves of PV system is nonlinear and variable with sun’s irradiation and temperature. To maximize the power utilization from a PV panel, a dynamic Perturb & Observe (P&O) MPPT algorithm is implemented using voltage and current sensors, a boost converter with digital signal controller (ds PIC4011). In any standalone PV system, the power conditioning unit receives energy from the PV source there by reducing the net power generation.

The paper “Reducing Energy Consumption in Wired OpenFlow-Based Networks” states that due to the proliferation of mobile devices such as smart phones and tablet computers, and increase in the speed of network devices to forward data, the Internet traffic has increased manyfold compare to a decade ago. Researchers are not only focusing on battery oriented network such as wireless sensor and ad hoc networks on saving battery power to extend network life but are also focusing on wired network to save energy consumed by network devices. Energy consumed by wired network can be reduced by putting underutilized network devices or links to sleep. If a network device has a few links such as a backbone network device, it is better to consider underutilized device to put to sleep, but if a network device has many links such as in data centers network devices and campus networks devices, it is better to consider underutilized links to put to sleep.

In the paper “Estimating Method for Lithium Ion Battery State of Charge based on Twin Support Vector Regression”, SOC is an important parameter of battery, which occupies an important position in BMS. This paper presents a modified method-Twin Support Vector Regression, based on SVR. To pick up current, voltage, ampere-hour, over fitting SOC of lithium ion battery (LIB), and making comparisons with traditional SVR.

The paper “Research on GUI-based Automation Test Technology Driven by Separated Definition Data” states that GUI-based software is often developed a complicated test script with existing traditional automation software testing tools. The software automated test development technology consequently carried out some study of existing automated testing with current automated testing tools to simplify the script. The paper proposed a novel test automation technology with separated definition data, which replaced by script development or modification.

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