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 “Sample Entropy Analysis of Heart Rate Variability during Rest and Exercise in Hypoxia” aims to study Heart Rate Variability during rest and exercise in normobaric hypoxia environment using sample entropy. Sample entropy is a powerful way to analyze non-linear biological system, it’s the first time to analysis hypoxia exercise HRV signal by sample entropy.

The paper “New Stability Analysis for Systems with Interval Time-varying Delay via a Delay-fractioning Approach” addresses the problem of stability analysis for linear systems with interval time-varying delay. A general form of the delay-fractioning approach is proposed, which not only takes advantage of all possible information on the delay's lower bound, but also exploits further information between the delay's upper and lower bounds. A new Lyapunov-Krasovskii functional (LKF) is constructed and delay-dependent stability criteria are derived in terms of linear matrix inequalities (LMIs) by using the piecewise analysis method. The convexity of the matrix function is used to avoid the conservatism caused by enlarging the time-varying delay to its upper bound in each subinterval.

In the paper “Investigation into Engineering Ceramics Grinding Mechanism and the Influential Factors of the Grinding Force”, the grinding force is a key parameter in the grinding process, which is closely associated with the grinding mechanism of engineering ceramics, microstructure and properties of ceramic materials, and the selection of grinding parameters. Meanwhile, it is also a key indicator to assess the grindability of a material. The grinding force is a crucial parameter to reflect the grinding process, which is closely related with microstructure and properties of the grounded material, grinding parameters, grinding wheel characteristics and material removal mechanism. In this paper, from the perspective of material removal mechanism in ceramic grinding model and the grinding process of engineering ceramics, the ceramics grinding process was analyzed and the formation of grinding force was explored.

The paper “Adaptive Time-to-Trigger Scheme for Optimizing LTE Handover” presents a handover optimization scheme in LTE for a variety of velocities. This scheme adjusts the time-to-trigger parameter based on received signal strength. The proposed algorithm demonstrates a more enhanced performance during a data link failure and ping-pong effect than existing algorithms focusing on a user’s position.
Paper “Study on Parameters Optimization Method of Fuzzy Neural Network PID Controller” states that in allusion to the insufficient of the traditional parameters optimization of the traditional fuzzy neural network PID controller, the parallel search characteristics of the ant colony algorithm in the whole parameter space is used. A parameters optimization method of the PID controller based combining the ant colony algorithm and fuzzy theory and neural network is proposed in this paper. The method used the ant colony algorithm to comprehensively optimize the parameters and structure of fuzzy neural network, which to be used to train and determine the parameters of the PID controller in order to get the fuzzy neural network PID controller.

The paper “The Application of Ideal Efficiency Analysis Mode on Contactless Excitation Energy Transmission System” states that as a brand of new power transfer system, contactless energy transmission system can be used to improve the security, dependability and flexibility of the power system. Contactless energy transmission technology is suitable for some special fields, so it has already been received the great concern of foreign academia and international engineering technological circle. Energy coupling realized by contactless magnetic tank transformer as new approach of rotator excitation in synchronous machine could replace brushes and slip rings of traditional excitation. This system reduces size, weight and cost of excitation system to great extent.

The paper “Impact of Voltage Reduction on Voltage Stability in Emergency Conditions” discusses that voltage reduction is one of the most common measures implemented to increase power reserves in emergency conditions. Since the power consumption of a composite load depends on the voltage, the power demand can be reduced by reducing the distribution voltage. Although the voltage reduction has a positive effect on power system in terms of securing reserve power, it may have a negative impact on the voltage stability in some conditions. Thus, it is necessary to analyze the effect of voltage reduction on the voltage stability. This paper analyzes the effect of voltage reduction on the voltage stability by performing PV analysis in various system conditions, such as base case on light load, heavy load, and contingency cases.

Paper “Analysis and Experimental Validation of a Space-Vector-Modulation Algorithm for Four-Leg Active Power Filter” analyses the configuration characteristics of the shunt active power filter (SAPF) and introduces a novel dead time control strategy in combination with three dimensional space-vector modulation (3D-SVM) strategies. The steps for the 3D-SVM implementation are identified. The switching vectors, 3D-SVM diagram and duty cycle calculation in abc coordinates, as well as the selection of the tetrahedron are discussed in detail. Moreover, based on the analysis of the APF’S dead-time effect with 3D-SVM control, a novel predictive direct current control algorithm is used for the APF’s inverter control.

In the paper “Selecting between Pick-and-sort System and Carousel System Based on Order Clustering and Genetic Algorithm”, a method is presented to select the suitable order picking system between pick-and-sort system, a type of semi-automated put system, and carousel system, a type of parts-to-picker system, for different types of customer orders, mainly determined by density and quantity. As policies of batching and zoning are essentially order clustering, the customer order sheet can be divided into unit grids. Then the time formulation for each system can be derived according to the logical movements in a unit grid and time sequence relationship among all unit grids. Genetic algorithm is adopted to search the optimal order picking time.
The Authors of “Estimation and Compensation of Non-deterministic Delays for Time Synchronization in Wireless Sensor Networks” discusses that new research opportunities are emerging as Wireless Sensor Networks (WSNs) are penetrating into the industrial domain; one such prospect is within time synchronization. For the operation of WSNs, partial or full time synchronization is needed. Time synchronization is very important in a distributed WSN for the purpose of data fusion, time interval calculation, context-free access to radio channel, coordination, event ordering and power management. This paper proposes a novel distributed time synchronization protocol for WSNs, which compensates for the nondeterministic delays by estimating the uncertainties in the synchronization packet delays.

In the paper “A Practical Scheme for Induction Motor Modelling and Speed Control”, a practical scheme for induction motor modelling and speed control based on field oriented control is presented. Simplified model of the induction motor is constructed for simulations, which is time-saving and very suitable for controller design in Matlab/Simulink. Actual rotor speed signal is measured to modify the original rotor flux observer, which cannot perform well at low speeds, and conventional proportional-integral controllers are used in both speed and current loops for a desired speed.

The paper “An Alternative Approach to Multiple Models: Application to Control of a Production Cell” states that an information system model represents a business establishment and reflects the realities of its organization and operations. One begins to build such a model by drawing a conceptual picture of the establishment as part of its real-world domain. Object-oriented methods and languages (e.g., UML, SysML) are typically used to describe the system at this level. The resultant representation includes several textual and diagrammatic descriptions and is completely heterogeneous in form, with several different conceptual bases. This heterogeneity and multiplicity of models has caused problems that demonstrate the need for consistency between a UML use case model and its corresponding set of textual descriptions. This paper contrasts that approach with a method that provides a single, integrated graphic model that incorporates function, structure, and behavior into an underlying conceptual representation.

The paper “QoS PreferenceAwareness Task Scheduling Based on PSO and AHP Methods” discusses that most existing task scheduling algorithms fail to aware users’ QoS preference and result in low user satisfaction rate for they do not reflect users’ QoS requirements. Authors classify QoS factors into four main QoS class which users understand well and can describe their important level, and introduce AHP method to help user decide the class weight and avoid judgment logical error. Then, they improve existing standard PSO scheduling by use above AHP based different weights for different QoS classes to make PSO have QoS preference awareness ability.

In the paper “Design of Wire-Crossing Technique Based on Difference of Cell State in Quantum-Dot Cellular Automata”, a wire-crossing is very important technique in quantum-dot cellular automata (QCA) design. Typical wire-crossing techniques have many disadvantages such as demanding of additional tasks and noise occurrence. This paper uses a relation between the locked and relaxed stages in order to achieve an efficient wire-crossing. The locked and relaxed stages have a fixed state such as a ground state or an excited state.
The Authors of “Determining System Design Space Relative to its Architecture and Preventive Maintenance Policy” discusses the search algorithm for optimal or near optimal solutions of preventive maintenance (PM) schedules performs the search within a confined design space. This space is an enclosure which consists of two layers; the outer and the inner layer. The outer layer is defined by set of system properties while the inner by combination of set of system properties and constraints imposed on the constituent components of the system. The total number of potential PM schedules exists within the outer layer while that of feasible PM schedules is within the inner layer. As the number of constraints increases, determining this number (in outer and inner layer) becomes more complex especially within the inner layer. A pre-knowledge of this number before optimising the system for PM schedules informs the system engineer about the size of the feasible region. This size could be used in predicting the amount of work in performing a search and also in other performance measures for a given PM optimisation problem.

The paper “A Set of Stabilizing PID Controllers for Multi input-Multi output Systems” is directed at the problem of designing a set of stabilizing proportional-integral-derivative (PID) controllers for each decoupled subsystem of a multi-input multi-output system based on PID stabilization theorem. It is well known that state interconnection terms of i-th subsystem are arising out of N-interconnected subsystem dynamics can be treated as perturbation acting on that subsystem. An LMI optimization problem is formulated to ensure the stability of the composite system while the designed decentralized controllers are employed. A genetic algorithm based search technique is adopted to select an optimal PID controller gains from a designed search space of stabilizing controllers in order to have an optimum value of performance index.

In the paper “Electricity Load Forecast Emulation Research Based on the Multi-model Merit”, in order to overcome the problems which are difficult to be accurately predicted, such as voilent vibration, large amplitude, and pseudoperiod, Authors put forward a load-classification method and a model-selection method following a multi-model merit. The multi-model merit can be realized by the result of Network training, so they can forecast the load of iron and steel enterprises respectively. In this way, they can avoid the limitations of traditional load forecasting methods which simply depend on sample data. In the framework of this model, to minimize the load forecast error is the target. On the one hand, it can be convenient to add new models into the framework, so as to improve the accuracy of the prediction, find more characteristics of the load, and better the model.

The paper “The Fuel Economy Analysis of Series Hybrid Electric Bus with Different Energy Storage Devices” states two kinds of energy strategy devices of series hybrid electric bus, Ni-MH battery and super-capacitor, are used in this paper. The influence of using different energy storage devices on fuel economy of the series hybrid electric system is analyzed by power flow method.

The Authors of “Microcontroller ATmega8535 Based Solar Tracker Design for PV System Applications in Equator Region” discusses that in order to be effectively utilizing the sunlight energy into electricity, the photovoltaic modules should be perpendicularly to the sunlight direction. However, the orientation of sunlight on Earth’s surface is varied that makes it difficult to find the optimal direction. For this reason, the solar tracker should be available to drive modules in the expected direction. In this study, the solar tracker is designed based on microcontroller ATMega8535 and the position is adjusted based on the IC RTC timer
response. The IC RTC is able to regulate the movement of photovoltaic modules about 15 degree per hour. The updating position of PV module is constantly changed, but the approach is enough for capturing sunlight energy for PV applications in equator region.

The paper “Optimized Design for Electric Vehicle Quick Charging System in Consideration of Economic Feasibility” simultaneously realized fast charger and low charger for electric vehicles by designing the driving power supply for the synchronization and interface of the battery system and power converter equipment of electric vehicles. In addition, it allowed the power of the output voltage and current to be supplied at a rate that is freely determined by user's setting regardless of the type of battery and power source, and also the charge and discharge devices for electric vehicles were developed using DSP.

Paper “Transfer Function Approximation via Rationalized Haar Transform in Frequency Domain” presents discusses that for system analysis and design purposes, it is meaningful discussion to define control system pole status whether a pole is significant or not. If a pole is less important, it can be canceled from the transfer function of system and system order is reduced. In this paper a method for system order reduction of transfer function using Rationalized Haar functions based on approximation and transform algorithm is presented. The Haar function set forms a complete set of orthogonal rectangular functions such as Walsh and block pulse functions.

The paper “Research on Fuzzy Self-tuning PID Control to Servo System of Airborne Radar” researches on application of parameters fuzzy self-tuning PID control to radar servo system. This method overcomes some defects of traditional PID control by perfecting the PID parameter. The principles and designing method of fuzzy self-tuning PID controller are given.

The Paper “High Power Full-Bridge DC-DC Converter using a Center-Tapped Transformer and a Full-Wave Type Rectifier” proposes a high power full-bridge DC-DC converter, using a center-tapped transformer and a full-wave type rectifier. The proposed converter realizes unipolar primary voltage switching, using the unipolar pulse-width modulation (PWM) technique. Also, the proposed converter reduces the freewheeling conduction loss, using the unipolar PWM technique and a resonant circuit, composed of a clamp capacitor and resonant inductor in the primary, and thus achieves high efficiency. However, because the proposed converter uses only a full-bridge circuit, center-tapped transformer, and full-wave type rectifier, the structure of the proposed converter is simple. In this paper, the operational principle of the proposed converter is described in detail, and a design example of a proposed converter prototype is shown.

The Paper “An Adaptive Resource Allocation Scheme for Improving VoIP Capacity in Mobile WiMAX Systems” states that in WiMAX networks, a base station (BS) sends DL-MAP and UL-MAP messages through downlink channel to represent transmission information, such as the size of slots/symbols and modulation/coding scheme (MCS), etc., for each of downlink and uplink data bursts. However, the MAP messages act as overheads. Particularly, in a service flow (SF) with the unsolicited grant service (UGS) schedule type, it is inefficient to allocate radio resources for transmitting the MAP messages on every grant interval because the grant interval and the requested bandwidth are fixed in UGS. This paper proposes an adaptive scheme using policy and charging control (PCC) architecture to reduce the MAP overheads in WiMAX networks, and prove the network capacity enhancements in the view of VoIP services.
The paper “Reduction in Encoding Redundancy over Visual Sensor Networks” states that visual sensor networks (VSN) are wireless sensor networks in which each sensor has video capture and processing capability. Power consumption may be examined for encoding, transmitting, and receiving subsystems, and research has been performed on minimizing these power levels in parallel. When multiple camera modules of a visual sensor node are aimed at the same objects with different fields of view (FOVs), the captured images may overlap. Such overlapped FOVs give rise to encoding redundancy over the VSN and also lead to increased power consumption among adjacent nodes. The power-rate-distortion (P-R-D) is determined and used to construct an optimization problem for minimizing power consumption of each node, hence maximizing node lifetime. The optimal solution provides distributed power allocation and node scheduling over the VSN at the same time, via simple information sharing, resulting in network lifetime maximization.

In the paper of “An Improvement Detection Technology of APF based on the Digital Sliding Filter”, with the use of the power electronic device, the grid is more and more serious from the harmonic. This paper improves the related link of active filter on the basis of the predecessors. Firstly, the traditional method uses low pass filter in the filtering process of harmonic detection technology. Secondly, the traditional method uses the Hysteresis comparison control and triangle carrier wave control on the current control strategy.

The paper “Development of a Remote Embedded System Controlled by a Mobile Device” states that remotely controlled Home Automation is popular these days, but it is usually applicable to recent appliances only. In order to utilize old devices in the automation, Authors have developed a model that integrates conventional electric/electronic devices into the automation. They have named the modelWhaut (Wireless Home AUTomation), in which a mobile terminal is used to trigger the control through Weband an embedded unit is used to control the target appliances.

Paper “Robust Controller Design for the Cooperative Control of Lower Extremity Rehabilitation Robot” proposed a robust controller design approach for Lower Extremity Rehabilitation Robot (LERR) with automatic gait adaption. Based on the developed LERR dynamic model, the robot system is first decoupled into some independent second-order integral systems using inverbility decoupling method. Then a robust optimal PID controller is proposed for each sub-system to cope with the uncertainty in the system modeling by converting the PID controller design problem into a static output feedback $H_2 / H_\infty$ multi-objective optimization problem. The adaptive control methods are further investigated for a compliant gait trajectory planning.

The paper “Influence Research of Cavity Shapes on Temperature Field of Multi-pad Hydrostatic Thrust Bearing” states that in order to compute the thermal deformation of the hydrostatic thrust bearing in the heavy type CNC equipment, a numerical research concerning temperature field of multi-pad hydrostatic thrust bearing having sector cavity, rectangular cavity, I-shaped cavity and ellipse cavity is described. Three-dimensional temperature field of gap fluid between the rotation worktable and the base has been simulated by using Finite Volume Method of CFX. This study analyzes the influence of cavity shape on the bearing temperature performance according to computational fluid dynamics and lubricating theory. It has revealed its temperature distribution.
The paper “Study on the Technology of Digital Recognition in Verification Process of Mechanical and Electronic Anemometer” states that in order to solve the key technical problem in the verification process of mechanical and electrical coal mine anemometer, the paper presents digital recognition approach base on the characters of the anemometer image. First of all, collect the mirror images of the anemometer from a plain mirror which in the wind tunnels. And then Authors process the mirror images with secondary mirroring, grayscaling, denoising and binarization. Followed the location of the digital area can be determined and the incline distortion of the image can be adjusted. The final step is segmenting the single character in the digital character region and identify the corresponding number base on the characteristics of anemometer, which using the LED digital tube to display numbers.

The Authors of “P-S Time Observation based on Laser Interferometer Seismic Signal Data” discusses that in seismic signal detection, it is important to detect seismic wave and P-S wave arrival time. Seismometers or accelerometers which are used as seismic wave measurement system have some limits to detect seismic signal. In order to overcome these limits, Authors propose the seismic wave measurement device based on a heterodyne laser interferometer. Heterodyne laser interferometer is used as the distance measurement device which has measurable range from nanometer to several meters.

Paper “Application of Improved Neural Network in the Automotive Engine Fault Diagnosis” presented a discussion that the back propagation neural network is a network, which is a multilayer feedforward network of according to the error back propagation algorithm training, i.e., BP neural network. The good nonlinear mapping ability of BP neural network can be a good application in engine fault diagnosis, but the traditional BP network has the trend of forgetting old samples during the training process when learning new samples, and exists the drawback of low training accuracy. Therefore, a model of improved BP neural network is constructed. A neural network algorithm of increased state feedback in the output layer is designed in this paper.

The paper “Multi-physics Field Analysis of Nuclear Power Valve based on MDO Model” states that in order to construct the characteristics evaluation system of nuclear power valves, multi-physics analysis (including structural static analysis, thermal-mechanical coupling analysis, flow field analysis and Seismic analysis) are completed on a typical nuclear power valve based on finite element analysis (FEA). Binding the load standard of ASEM, each performance index of the nuclear power valve is tested and forecasted in order to verify the safety performance. Meanwhile, in view of the demands in multidisciplinary design optimization (MDO) of nuclear power valve products, the MDO model for valves is established, which integrates multi-characteristic simulation and multidisciplinary design of nuclear power valves together.

The paper “Optimum Bistatic Angle Extraction Using Compressed Time-Frequency Feature Vectors” Mode” states that when the target of interest is determined, the transmitter and receiver positions of bistatic radar are of great importance at the aspect of radar target classification. The radar cross section (RCS) of a target varies with these positions, and the target classification performance is considerably influenced by RCS. In this study, the target classification performance using the bistatic scattering data of wire targets and scale-model targets is analyzed and compared. Time-frequency analysis and effective compression
techniques are used for target feature extraction from the bistatic scattering data of each target, and a multilayered perceptron (MLP) neural network is used as a classifier.

Paper “Design and Application of a NEW Seven-Dimensional Hyperchaotic System” states that because the chaotic characteristics of the hyperchaotic system is more complex, so design a higher dimensional hyperchaotic system has become a new orientation of the chaos theory research. This article construct a seven-dimensional third-order hyperchaotic system, this system is proved to be hyperchaotic through the MATLAB simulation and the Lyapunov exponential calculation.

The Authors of “A Clonal Selection Algorithm for Classification of Mangroves Remote Sensing Image” discusses that as a new computational intelligence model based on artificial immune systems, clonal selection algorithm has been widely utilized for data analysis and pattern recognition. Recently it was applied to remote-sensing image classification. However, due to the similar spectral feature between mangroves and other land cover types such as agricultural land and forests, serious misclassification and confusion can develop in mangroves classification using conventional methods. This paper proposes a clonal selection based supervised classification algorithm which takes into account not only spectral feature but also geographical feature and image feature. The proposed algorithm searches the best cluster centers for various types of training samples by the improved clonal selection algorithm. The antibody represents the candidate solution, while antigen is reflected by affinity function. The antibody is encoding by decimal way. The inner superiority and the outer superiority together are used to measure the superiority of antibody. The selection operator and mutation operator are designed to guarantee the diversity and global optimality.

The paper “An Improved Optimal Path and Energy Efficiency Routing Algorithm in Cyber-Physical Systems for Real-Time Basketball Player Monitoring” discusses that live physiological monitoring of basketball players during events can help maximize athlete performance while preventing injury and enhance TV broadcast services. However, the harsh conditions in the basketball court pose many challenges. In this paper, we propose an improved optimal path and energy efficiency sensor routing algorithm for athletes’ monitoring services. The goal is to pave the way to the realisation of real-time athlete monitoring systems. In our scheme, the basketball court diagram and player default positions are given for the connectivity data collection. Then the radio signal propagation model is set up. Additionally multi-hop routing algorithms for real-time monitoring are analysed. Finally the IOPEESRA algorithm is proposed.

In the paper “Comparison of Neural Network and Fuzzy Logic Control for Nonlinear Model of Two Link Rigid Manipulator”, a model with multiple inputs and multiple outputs is considered to simulate two links rigid manipulator. Its mathematical model is obtained by using Euler’s Lagrange method. A new intelligent scheme based on fixed stabilization technique is proposed in this paper for controlling the system. Comparison of Neural Network and Fuzzy Logic controller designed by utilizing this technique is also presented. The control
law is determined such that the system output follows the reference trajectory. Controller design and simulation is done in MATLAB & Simulink.

The paper “Study on Stable Estimation Method for Lead-acid Battery SOC by Extended Kalman Filter” states that a stable state of charge (SOC) estimation method which can adapt to variable current environment through adjusting noise covariance is proposed in this study. The accuracy of battery SOC estimation is the important factor in battery management system. First, the cause of instability on SOC estimation using Kalman filter is analyzed, and then an extended Kalman filter (EKF) is used to build up state space equation.

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