Editorial

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The distributed power generation systems and networks have received more and more attention from both the academic community and market opportunities. Distributed power generation systems can offer secure and diversified fuel options with low or zero greenhouse gas emissions. There are tremendous opportunities for distributed power generation systems, the result of:

1 deregulation of the power industry

2 mandates to reduce greenhouse gases.

The academic community and market opportunities are long term and world wide. Along with the rapid development of hardware and some intelligent control methods, the distributed power generation systems are being further developed and researched.

To eventually realise these related technologies combined applications, significant efforts are still needed from both the academic community and industrial fields, since the requirements for supporting these related technologies raise many challenging issues related to fuel cells, electrical system optimisation and long-term viability. In this special issue, we solicit research papers on all aspects of intelligent computing theory and methodology, sustainable energy and environment, distributed power generation systems and network. The contents of these papers are briefly outlined as follows.

The first paper in this special issue is on 'Direct Nyquist array design of PID controllers for boiler-turbine units based on gain and phase margins'. In this paper, a direct Nyquist array (DNA) method for the design of PID controllers for multivariable boiler-turbine units with specifications of gain and phase margins is proposed. The essential objective is to propose a method for the design and auto-tuning of both straightforward and robust PID controllers that can be more easily implemented for the boiler-turbine units in coal-fired power generation plants in the same framework. For this purpose, the model of the original multi-input multi-output (MIMO) system is first converted into a diagonal/diagonal dominance matrix after the system is appropriately compensated. Then, various PID controller design methods for single-input single-output (SISO) systems can be easily extended to decoupled or quasi-decoupled MIMO systems. In particular, the proposed method allows the user to specify the robustness and other key performances of the system through the gain and phase margins specifications.

The second paper in this special issue is on 'Copula estimation of distribution algorithms based on exchangeable Archimedean copula'. The two key operators in estimation of distribution algorithms (EDAs) are estimating the distribution model according to the selected population and sampling new individuals from the estimated model. Copula EDA introduces the copula theory into EDA. The copula theory provides the theoretical basis and the way to separate the multivariate joint distribution probability function into a function called copula and the univariate margins. The estimation operator and the sampling operator in copula EDA are discussed in this paper, and three exchangeable Archimedean copulas are used in copula EDA. The experimental results show that the performances of the three copula EDAs perform equivalently to some classical EDAs.

The third paper in this special issue is on 'Projection ray intersecting location-based multicolour pseudo-random coded projected active vision method'. 3D reconstruction has been recognised as an important cue for tasks like active computer vision and image understanding. This paper presents an active vision method of multicolour pseudo-random encoded projected for recovering the 3D shape of surface from one calibrated image, based on projection ray intersecting location. This method combines geometric and photometric information in order to reconstruct 3D shape only calibrating camera parameters and projection rays. Based on the thought of ray intersecting location, by projecting pseudo-random coded pattern onto surface of object, using a projected ray of a feature point at projector side, and an imaging ray of the same feature point received by camera, the 3D reconstruction is implemented by seeking the intersection point of the projected ray and the imaging ray. Experimental results on the real world images show that the proposed method reconstructs the 3D shape of objects very efficiently.

The fourth paper in this special issue is on 'New delay-dependent stabilisation criterion for a class of networked control systems'. Networked control systems (NCSs) have been one of the main research areas in academia as well as in industry for many decades. This paper investigates the delay-dependent stability criterion based on a newly developed NCS model including all these network phenomena. By introducing new Lyapunov functional candidate and free-weighting matrices techniques, the bounds on the maximally allowable transmission interval (MATI) is derived, which guarantee stability of the NCS in the presence of communication constraints, and the criteria of delay-dependent asymptotical stability for systems are analysed. The efficacy and feasibility of the proposed methods is shown by presenting simulation results.

The fifth paper in this special issue is on 'The crack edge enhancement of straddle-type monorail track beam surface based on non-subsampled contourlet transform'. This article introduces a new algorithm of crack edge enhancement of straddle-type monorail track beam surface based on non-subsampled contourlet transform (NSCT). According to the characteristics that the low frequency can be retained and mid-frequency can be enhanced by fractional differential approach non-linearly, a new enhancement method that the smooth sub-band of NSCT domain can be enhanced by fractional differentiation has been proposed; while in the high-frequency sub-bands of NSCT domain, each pixel of high-frequency sub-band is divided into strong edge, weak edge and noise on the basis of direction sensitivity characteristics, then the weak edge can be enhanced non-linearly, strong edge be retained, and noise be removed by a new constructed non-linear function.

The sixth paper in this special issue is on 'Inspection of surface defects in copper strip using multivariate statistical approach and SVM'. The surface quality would directly influence the capability and quality of the final product. According to the gradual change of intensity levels of copper strips surface defect, a defect detection algorithm is proposed using wavelet-based multivariate statistical analysis. First, the image is divided into several sub-images, namely, statistical units, and then each unit is further decomposed into multiple wavelet processing units. Then

each wavelet processing unit is decomposed by 1D db4 wavelet function. Then multivariate statistics of Hostelling are applied to distinguish the existence of defects and classify the defects using support vector machine (SVM). During SVM design, the authors use cross-validation method to get the best parameters and then use the parameters to train and test the samples. Finally, the defect detection performance of the proposed approach is compared with the traditional method based on greyscale. Experimental results demonstrate that the proposed method has better performance on identification, especially its application in the ripple defects can achieve a 96.7% probability of detecting the existence of micro defects, which was poor in common algorithms.

The seventh paper in this special issue is on 'Location for high impedance fault and polluted insulator in transmission line-based non-linear frequency analysis'. The efficiency of power system is based mainly on the continuity of the service, avoiding faults that suppose economical losses for utilities and users. It is very important to detect, locate and eliminate the faults of a power system, especially on power transmission lines. This paper presents a new method based on non-linear frequency analysis for online detection and location of the high impedance faults occurred on power transmission line, which has been one of the most difficult problems in power transmission and distribution systems. The proposed technique is based on the non-linear characteristics of the high impedance faults and severely contaminated insulators on power lines. The non-linear frequency responses related to the signal of power line carrier were used to detect the occurrence of the high impedance fault. The location of the fault and the degraded insulator on the power lines could be determined by detecting the position of the non-linear component in the power transmission system. The effectiveness of the method has been verified through simulation studies.

The eighth paper in this special issue is on 'An improved multi-objective ant colony algorithm for building life cycle energy consumption optimisation'. Building energy consumption (BEC) is very important for the environmental sustainability.

Because of complexity and variety of BEC, to achieve BEC optimisation, especially, for building life cycle (BLC), multiple objectives have to be satisfied. In this paper, a novel mathematical model for BLC energy consumption assessment is formalised, a novel algorithm for optimisation of BLC energy consumption is developed by improving the multi-objective ant colony optimisation (MACO). In the algorithm, the estimation mechanism of Pareto optimal solution and the update rule of pheromone are derived. An efficacious optimisation solution for BLC energy consumption and an innovative application of MACO algorithm in the building energy efficiency area are presented in the paper.

The ninth paper in this special issue is on 'Application of interval type-2 fuzzy neural networks to predict short-term traffic flow'. Traffic flow prediction is one of the most critical issues in the ITS and plays an important role in the routine guidance, traffic emergency detection, urban traffic management and control, etc. This paper presents a new prediction model based on interval type-2 fuzzy neural network and self-organising learning algorithm, i.e., IT2FNN model. Unlike traditional intelligent prediction models, whose structure and parameters must be predetermined by expert experience or professional knowledge, the IT2FNN model determines its own form by the self-organising structure identification and parameter optimisation algorithm. In the structure identification stage, the hierarchical clustering algorithm which includes lower-layer subtractive clustering and upper-layer FCM clustering is employed to determine the size of the IT2FNN predictor. Then, in the parameters optimisation stage, the steepest gradient descent algorithm is also utilised to optimise the free parameters. Finally, two groups collected traffic flow data, which came from the 3rd ring freeway, Beijing and I880 urban freeway, California are employed to train and evaluate the IT2FNN predictor.