Guest Editorial on the Special Section on Intelligent Control

It is our honor and privilege to serve as Guest Editor of the special section on Intelligent Control for the International Journal of Control, Automation, and Systems (http://www.ijcas.com).

Nowadays, highly complex systems are required due to increasing technological demands. These complex systems usually cannot be well-controlled by conventional approaches. Intelligent control of these complex systems is necessary to ensure that high performance can be achieved and maintained under different environments. Consequently, the study and design of intelligent control are crucial to complex systems.

Intelligent control is a fusion of a number of research areas in systems and control, computer science, operations research and others. Intelligent control mainly includes: adaptive control, fuzzy control, neural net-based control, knowledge based control, hybrid intelligent control, learning control, evolutionary mechanism based control, multi-sensor integration, failure diagnosis, reconfigurable control, and so on. They are often interconnected to operate within an architecture that is hierarchical and often distributed for complex dynamical systems. The special section aims at exhibiting the latest research achievement, findings and ideas in the areas of intelligent control.

Out of 38 submissions from 12 countries and regions across America, Asia and Europe, this special section selects 5 representative papers. All submissions were peer reviewed according to the journal guidelines. The papers published in the special section describe the latest research findings and ideas in the areas of intelligent control. The papers cover a wide range of interesting issues in intelligent control, which can be described in brief as follows.

The first paper proposes a Golden-Section adaptive controller for the tracking control of robotic manipulators with unknown dynamics. The unknown dynamics of the robotic manipulator can be described by a characteristic model of a second-order time-varying difference equation. An adaptive algorithm that combines the Golden-Section adaptive control law with the weighted least squares estimation for the control of robotic manipulators is presented based on the characteristic model. A compensation neural network is incorporated into the designed controller to reduce the influence of the estimation error. The control result shows the effectiveness of the combination of the characteristic model and the Golden-Section adaptive controller design.

The second paper proposes direct and indirect adaptive fuzzy sliding mode control approaches for a class of nonaffine nonlinear systems. The implicit function theory is used to prove the existence of an ideal implicit feedback linearization controller for the direct case. The linear structure of a Takagi-Sugeno fuzzy system with constant conclusion is exploited to establish an affine-in-control model, and an indirect adaptive fuzzy controller is therefore designed for the indirect case. In both instances, the adaptation laws of the adjustable parameters are deduced from the stability analysis to get a more accurate approximation level. The design of the proposed approaches does not require the upper bounds of both external disturbances and approximation errors.

The third paper focuses on a new optimization technique of a fuzzy logic based proportional integral load frequency controller by the multiple tabu search algorithm. The algorithm is used to simultaneously tune proportional integral gains, the membership functions and control rules of the frequency controller in order to minimize the frequency deviations of the interconnected power system against load disturbances. The algorithm also introduces techniques for improvement of the search process such as initialization, adaptive search, multiple searches, crossover and restart process.

The fourth paper proposes a data fusion algorithm of nonlinear multi-sensor dynamic systems. The object state variable is first predicted by the previous global information and the predicted estimation is then updated by use of the extended Kalman filter when all of the observations are available. A

fusion algorithm is proposed to estimate the object state variable based on the system global information. The algorithm can obtain better performance than the traditional nonlinear data fusion algorithms.

The last paper is related to the networked control system. The uncertain network-induced delay and nonlinear controlled object are the main problems. A sufficient condition of the robust asymptotic stability is proposed for the networked control system. The maximum network-induced delay that insures the system stability is obtained.

ACKNOWLEDGEMENT

The Guest Editor would like to express their sincere appreciations to the Editorial Board of the International Journal of Control, Automation, and Systems for their trust and support. Appreciations go to all the authors for their invaluable contributions in making this special section a success. Special thanks are extended to Ms. Jin Young You and Dr. Luo Xiong for their efforts and supports provided in making this special section possible.

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