SS04: Fuzzy and Intelligent System

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This special session collects papers that reflect current progress in the research about fuzzy and intelligent systems. We hope those papers accepted can provide some milestones for the related research fields and also give ideas for further exploration in their research issues. Totally, nine papers are accepted in this session. Among them, six papers are about fuzzy theories and the related applications are included. The remaining three papers are about intelligent systems. Those papers are also in line with the subject of conference (Joint 17th World Congress of International Fuzzy Systems Association and 9th International Conference on Soft Computing and Intelligent Systems). The contributions of those papers are stated as follows.

No. 9: Positivstellensatz Relaxation for Sum-of-Squares Stabilization Conditions of Polynomial Fuzzy Systems

Stabilization conditions based on a sum-of-squares (SOS) approach of polynomial fuzzy model has been derived. A piecewise-polynomial-Lyapunov-function-based approach was employed to do a stability analysis of polynomial fuzzy model. Based on the results of the simulation using a benchmark design example the feasible solution can be achieved for $b = 6.5$ when $k = 1$.

No. 14: Online System Identification Based on a State-Space Neuro-Fuzzy System

This paper addressed the problem of Neuro-Fuzzy Systems modelling. A new general state-space Neuro-Fuzzy model structure has been proposed and presented results regarding the universal approximation property. Results taken from experiments on a benchmark heating system demonstrated the approachs relevance and showed its ability to cope with time-varying nonlinear dynamics.

No. 16: Stability Analysis for Polynomial Fuzzy Systems Based on Line-Integral Fuzzy Lyapunov Function: A Copositive Relaxation Approach

Line-integral fuzzy Lyapunov function candidate was considered to derive SOS stability conditions for polynomial fuzzy systems. A copositive relaxation was employed in order to get more relaxed conditions without needing to add slack variables. Results obtained by using derived conditions have been compared to other existing results. An advantage of using copositive relaxation and SOS conditions is to have less constraints and can be used to prove stability for polynomial fuzzy systems.

No. 31: Cooperative adaptive fuzzy tracking control for a class of nonlinear multi-agent systems

In this paper a cooperative tracking problem is investigated for a class of uncertain nonlinear multi-agent system with partially unknown dynamics. By using both artificial potential functions and robust control terms, a robust controller is designed for the agents. The unknown nonlinear dynamics of the system are approximated by the aid of fuzzy systems.

No. 34: A Design of Uncertainty Trajectory Observer for a Class of T-S Fuzzy Models

Virtually dividing the uncertainty into a constant part and a time-varying part, this paper proposed a UT observer that is able to effectively track the uncertainty trajectory. Example was provided to demonstrate the effectiveness of the approach proposed.

No. 116: Design of Self-Constructing Fuzzy Wavelet Neural Control System

In this paper, a SFWNN approximator, in which the number of fuzzy rules can effectively generate and prune by the structure learning, is designed to on-line approximate the unknown nonlinear term of the system dynamics. Furthermore, this paper proposes a SFWNC system which is composed of a computation controller and a robust compensator. Finally, the simulation results are provided to demonstrate the robust control performance of the proposed SFWNC scheme.

No. 133: An Obstacle Avoidance of Large-Scale Indoor Tricycle Drive Cleaning Robot Using Laser Scanner

A cleaning robot, facilitated with scanning and path planning functionality, has been successfully prototyped. The robot is suitable for cleaning job at any public place, resolving the problems of large manpower demand, insufficient labor, and workers overwork/fatigue.

No. 167: Tuning of Fuzzy Rules with a Real-coded Genetic Algorithm in Car Racing Game

In Car Racing Game, we apply a real-coded genetic algorithm to tuning the consequent values of fuzzy rules. As a result, we have found the fuzzy rules that win almost all opponents which have actions of waiting near the current way point for approaching of the opponent to the current way point, which are not supposed in the original fuzzy rules.

No. 173: Emotional Action Generation Model Supporting Real-time Operation

In this paper, based on Nagano's model, we have proposed an emotional action generation model that supports real-time operation. However, the current model has a problem, i.e., robots can not process irregular inputs when their number increases in a prescribed period. Moreover, the RNN in this model learns emotional actions to classify nine emotions as joy, angry, sad, and happy. Therefore, the numbers of emotional actions by each emotion are less. These problems will be considered in future work.