Study of Principle and Applications of K+NN, a New Controller Structure, for Control System Design

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ABSTRACT

Soft computing includes artificial intelligence, expert systems, fuzzy logic, neural network (NN), particle swarm optimization and evolutionary computations. Use of those methodologies to improve computer algorithms can make computers smart enough to do some intelligent inferences for applications. Furthermore, the combination of soft computing technique and the conventional control can further improve the performance of the original control systems (controlled solely by its conventional controllers). Incorporating the soft computing technique to the control system design, a NN based K+NN assistor is provided to aid the original control systems so that improvement of transient responses becomes possible. Error signal and error rate are two inputs to this K+NN structure, NN will send out a control signal as the output. SE is the gain for error input, SDE is the gain for error rate input, and SU is the gain for NN output. These three important scaling factors dominant the design process of the K+NN assistor. K is the parallel gain between error signal and NN output. Finally, the combined output (NN and K) is in series with another gain called Ka constitutes the whole structure of a K+NN assistor. All necessary parameters for K+NN assistor can be found off-line by using PSO technique. If necessary, the parameters of the original controllers can quite well included together in PSO parameters finding. Lastly several examples are illustrated to prove the capability of using K+NN as an assistor/controller and as a plant modifier. K+NN can be a plant modifier, a stand-alone controller, or an assistor to the original controller. This effects can be found in this thesis.

Keywords : Neural Network 、 PID Controller 、 Fuzzy Logic 、 Particle Swarm Optimization

Table of Contents

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