

SISTEMA DE CONTROL INTEGRADO NEURO-FUZZY (SCINEF) NEURO-FUZZY EMBEDDED CONTROL SYSTEM

ABSTRACT

This work presents a parallel hybrid control system that uses as main tools Fuzzy Logic and Artificial Neural Networks (ANN), showing the practical applications that these technologies have in the industry. Neural-Fuzzy Embedded Control System (SCINEF) was applied to the control of a 1MW power generator to optimize its set point, diminishing in that way its fuel consumption up to a 20% and decreasing the generator and refrigeration systems wear. SCINEF includes RS232 and RS485 serial communications modules with speeds up to 115.2 Kbps, programmable digital inputs/outputs, relay outputs, parallel printer port, AD/DA converters to the analog interface with the fuzzy micro-controller as general purpose analog input/output, analog voice play/recording module and Smart Cards interface. As main computing module, it uses a Z80180 processor that can be programmed in C and assembler languages, in which it was implemented, besides the conventional digital control, the ANN. The fuzzy logic processing module uses the Programmable Analog IC (PAIC™) AL220 which can use up to 4 analog inputs and 4 analog outputs, 111 fuzzy variables and 50 rules that can be evaluated up to a speed of 500K rules/sec. The ANN used is a feed-forward with 2 inner layers and the classic back-propagation was used as learning algorithm. The hardware was developed under the PC/104 standard for physical dimensions and control signals, giving the possibility of integrate any kind and quantity of peripheral devices that the system could require. The main advantages of this control system are its high response velocity, proved efficiency, hardware versatility, software flexibility, high learning capabilities and the fact that it is a system easy to adapt to different industrial processes without any kind of hardware modifications.

Keywords: Fuzzy Logic, Fuzzy Hardware, AL220, Neural Networks, feed forward, back propagation, Hybrid Control System, parallel processing, PC/104, Smart Card, Analog Voice Recording, Power Generation Control.