

**FUZZY LOGIC PI CONTROLLER WITH ON-LINE OPTIMUM INTERMEDIATE PRESSURE FOR DOUBLE STAGE REFRIGERATION SYSTEM**

ESNOZ, Arturo (1); LOPEZ, Antonio (2)

Departamento de Ingeniería de Alimentos y del Equipamiento Agrícola  
Universidad Politécnica de Cartagena

Paseo Alfonso XIII, 48 30203 CARTAGENA (Spain)

(1): Phone: +34 968 325721 ; Fax: +34 968 325433 ; Email: arturo.esnoz@upct.es

(2): Phone: +34 968 325516 ; Fax: +34 968 325433 ; Email antonio.lopez@upct.es

(1) Corresponding author

The traditional control system of refrigeration compressor have usually been based on incremental PI controllers. The progress in the electronic implementation of this controller is immense, but the performance can be improved. It is known that PI controller is not the most efficient in systems which the conditions change. On the other hand, in case of refrigeration systems with double stage compression is known that the selected intermediate pressure, usually the square root of the product of the evaporation and condensation pressure, is not the optimum in relation to the energy cost.

In this work, a new control system for these refrigeration systems is presented and evaluated: a Fuzzy Logic based Controller (FLC). The Fuzzy Logic has been used in wide range of applications inside refrigeration system. For example, in the scope of HAAVC system and the regulation of expansion valves. In this work, a FLC-PI has been used for the compressor regulation. This type of control has been chosen firstly because it is similar to the traditional PI and secondly since the FLC-PI has a no-linear behaviour. This usually implies an smooth and optimum performance. On the other hand, a new method to calculate the intermediate pressure is presented. With this method this pressure is changed online, and it allows to minimize the energy cost.

In conclusion, it has been probed that with this new control system FLC-PI with optimum on-line intermediate pressure, and considering the same work conditions and temperature perturbations observed really in a frozen food factory, the energy consumption is reduced a 10% and the FLC-PI build is not more complex than a traditional PI controller.