RESEARCH ON AUTOMATION SYSTEMS THAT USE GEOTHERMAL WATER ENERGY WHEN IS APPLIED TO FOOD INDUSTRY MACHINERY

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Abstract
Any scientific problem addressed systemically meets the condition, absolutely necessary, clearly stating the border area where they held all interests and interactions that take place both in and outside environment inside the border.

The concept of the system is composed of a system of processes and leadership programs for equipment. Together they form an entity, and the main feature of the system is the organisation and structure of their elements.

Structure of the system is in fact a way of organization of interconnected elements on the basis of relations between them as well as the restrictions imposed on compatibility. The whole system perfectly reflect the mode of interaction with the external environment.

If we consider any phenomenon or object in the material or information, we can identify a system as well as its characteristic structure. Thus, we can consider any apparatus or plant a separate technological system.

An important aspect in connection with closed-circuit systems is the inverse link or main reaction of the automation device and automated process. This reaction is very important, even essential, because automation device informs about the value of the size of the output y.

Key words: geothermal whater, fuzzy adjustment block, controller PID, food machinary

INTRODUCTION

Possible areas of use of geothermal energy are numerous (figure 1.) [Popovska.2000]. Basically, wherever there is a need for a relatively low temperature (150 °C), it can be obtained from geothermal water. Depending on the structure of the industry, the use of geothermal energy can be independent or in combination with heat energy of other origin (fossil fuels, electricity, bioenergy etc.). (Burkhard Sanner 2006, C. Pantea at all, 2010, J. W. Tester, et all, 2006, Setel Aurel et all, 2010)

The driving processes of systems that use geothermal water energy are complex processes and applies generally in the industry.

The use of technical-economic conditions favorable to this method involves at the same time conducting extensive studies and theoretical and experimental research on all the parts of the system in order to establish the optimal Variant driving. (Burkhard Sanner 2006, 4. Borangiu Th, 1986 C.

Pantea at all, 2010, Popovici M, 2012, J. W. Tester, et all, 2006, Setel Aurel et all, 2010)

Thus arose a number of leading methods capable of ensuring the control of parameters of interest to be obtained. Although equipment needed are more expensive systems were preferred and obviously researches of complexity higher or lower have been initiated and developed, aiming to establish the conditions under which such technologies could be applied with maximum efficiency.
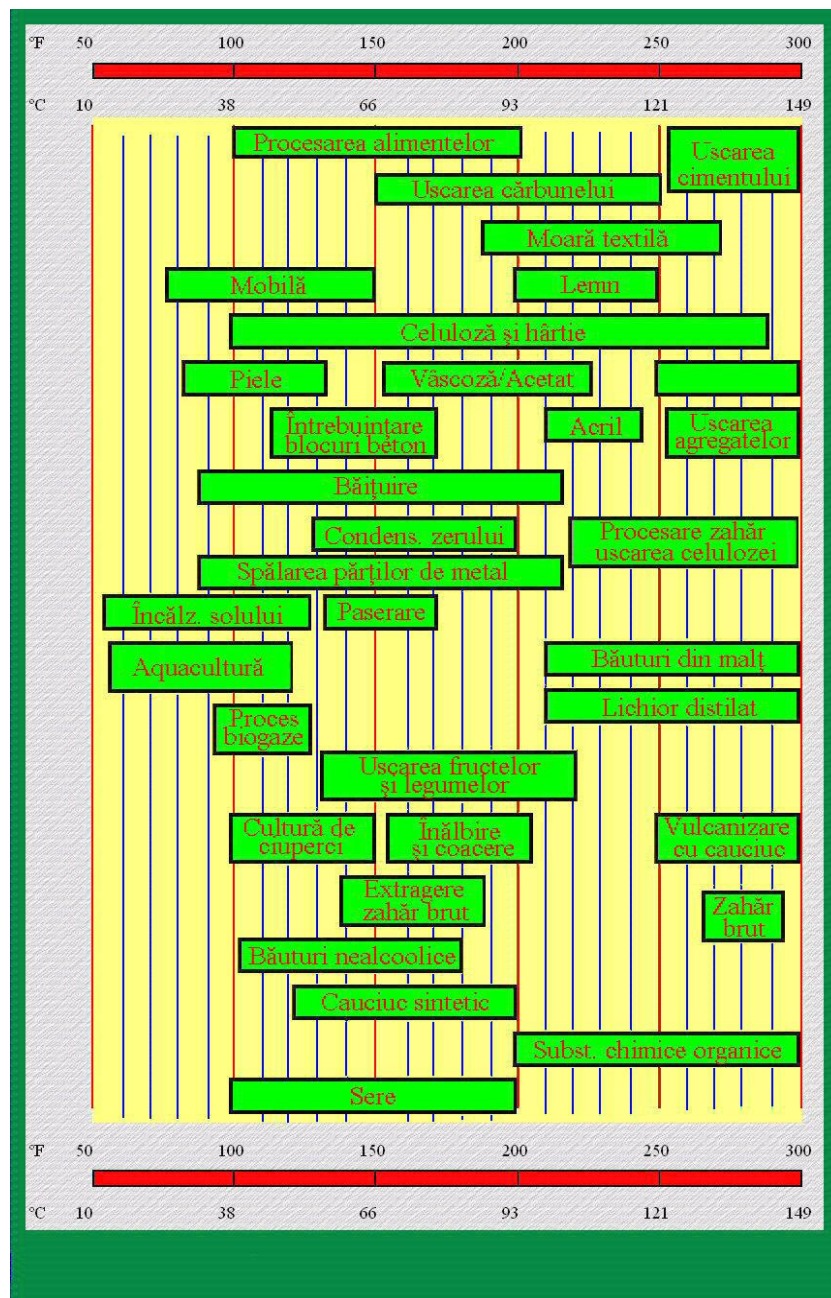
Fig. 1. The use of geothermal energy for industrial and agricultural processes
[Popovska.2000]

Expansion in recent decades of numerical control systems has awarded the use of systems that use geothermal water energy advantages. Researchers in the field of automation attention turned towards the study of aspects that are capable of contributing to a better clarification of the

meaning of process management and, on the other hand, the technological possibilities offered by this process. (A. Bara 2001, Astrom K. J, 2002, Astrom K. J, et all, 1984, 4. Borangiu Th, 1986, C. Popescu, 2001, Carmen Jover 2006, Iancu Carmen, 2010, C. Volosencu. 1997, Setel Aurel et all, 2010)

These are all arguments in favour of the idea that, underline present research on the processes of automatic driving systems are timely and necessary.

MATERIAL AND METHOD

In order to improve the characteristics of the system insert a P.I.D. controller (proportionally, derivativ), defined by the relation:

$$C(s) = \left[P + I\left(\frac{1}{s}\right) + D\left(\frac{Ns}{s+N}\right) \right] \qquad (1.)$$

Where N represents a filter coefficient that determines the placement of the filter's poles derivativ. (Carmen Violeta Iancu, et all, 2009, Iancu Carmen, 2010, Setel Aurel et all, 2010)

As the size of the reaction is defined by temperature and flow out of the muck that was calculated an "equivalent flow of reaction", and the reference was defined geothermal water flow. The aim of the regulation is to increase the productivity of the machine by decreasing the time required for drying at ambient temperature heating. (Iancu Carmen, 2010)

P.I.D. adjustment parameters was done using the PID Tunner in Simulink program library. This program carries out parameter adjustment to take account of the following P.I.D. objectives:
1. stability of feedback loop;
2. response as quickly – the wider the bandwidth with both controller respond more quickly to changing the citation or the disturbance;
3. robustness corresponding – the loop has a fringe of phase and gain big enough to cover variations in the dynamics of the system.

For equipment with fuzzy controller has been replaced with a block P.I.D. controller of fuzzy adjustment. (Crispin Allen, 1990, Iancu Carmen 2010, K. Leiviskä at all 2005)

For the definition of fuzzy inference system used "Fuzzy logic toolbox" of library programs MATLAB. (Carmen Violeta Iancu, et all, 2009, Iancu Carmen, 2010)

With the help of this program functions are defined by the membership and rules of inference:

1. membership functions of Gaussian input
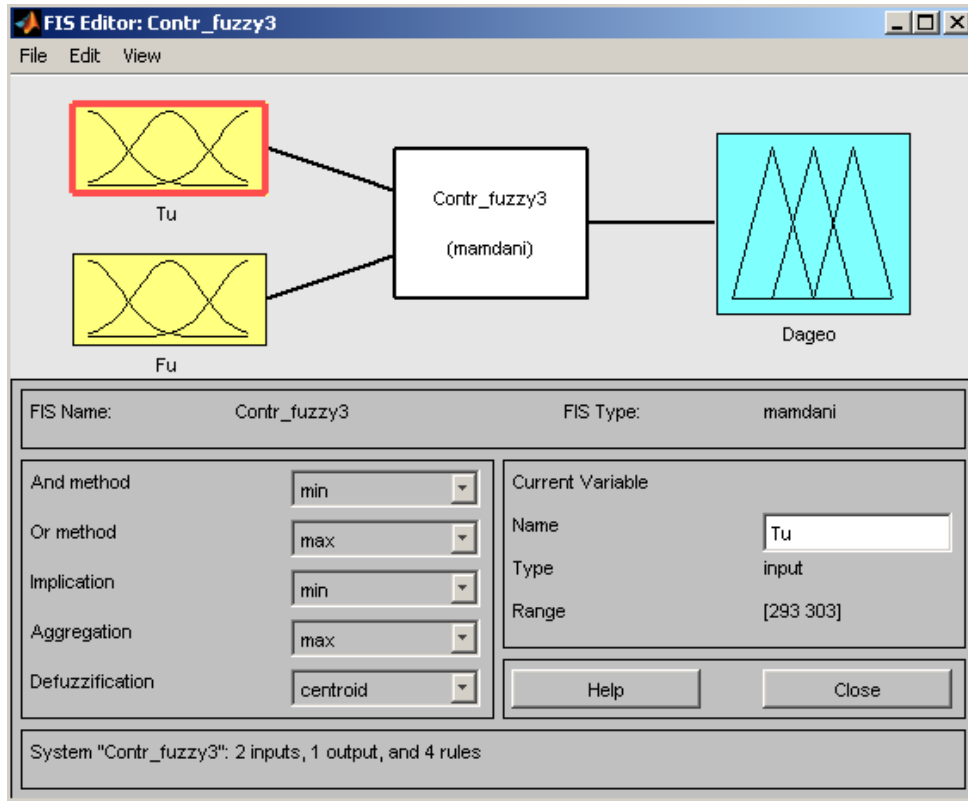2. membership functions of Gaussian output;

Fig. 2. File editor for adjustment system

For the purposes of mathematical treatment of linguistic variables for processing by fuzzy logic reasoning, relates the values of language functions of variables. In this context is assigned to each value of linguistic variables, a function of linguistic belonging respectively mf1 mf^2 whose values vary between 0 and 1, taking into account the classification of a sketchy overview. They are talking in this case fuzzificare. Functions of mf1 and mf^2 give a share of a particular input variable values Tu and Fu. The variables Tu can take values and fun in a crowd called universe of discussion. Thus the membership functions are functions defined on the universe of discussion with values in the range [0, 1]. (Carmen Violeta Iancu, et all, 2009, Iancu Carmen, 2010)

File editor shown in Figure 2 is released by fuzzy. The main window has three main menus on the taskbar commands through which it ensures that all orders for the development and management of the model.

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(Dionissios P, att all, 2006, E.F. Zanoelo att all, 2008, F. S. Blaga, 2009, H. Silaghi at all, 2009)

RESULTS AND DISCUSSION

By accessing the graphics of the system and the process of adjustment were obtained the following values of parameters:

P = 7.98987787686216;
I = 0.0366933589391168;
D =-558.174828254812;
N = 0.00411772359921642;

The phase used is 60 °.

In Figure 3. graphical user interface is presented to the programme "PID Tunner" with the response to the signal diagram step and shown in Figure 4. Bode diagram is presented.
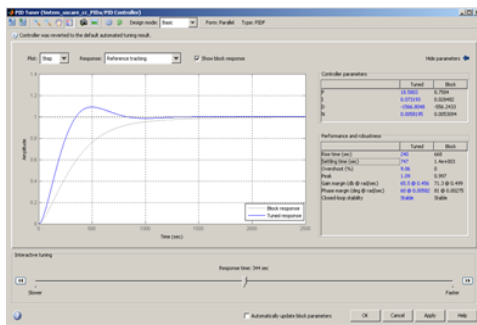
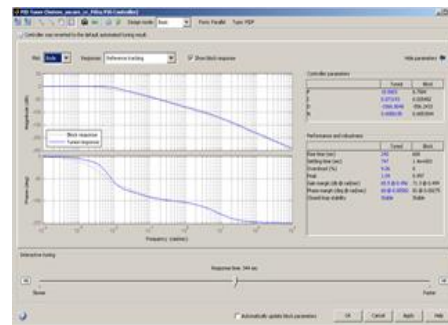|	
Fig. 3. The program of the controller parameters adjustment P.I.D. answering signal stage	Fig. 4. The program of the controller parameters adjustment P.I.D. Bode Diagram

By accessing the graphic elements of the fuzzy system open interfaces corresponding to the setting of functions for input variables which are given in Figure 5 and 6, respectively for the output variable as shown in Figure 7.
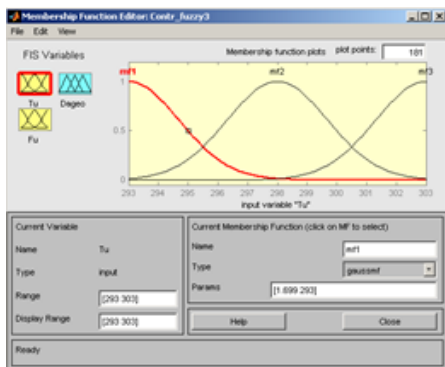
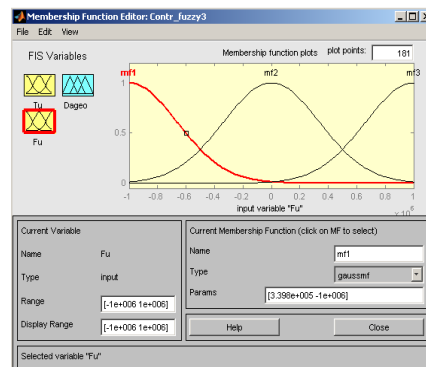Fig. 5. Input membership functions for temperature

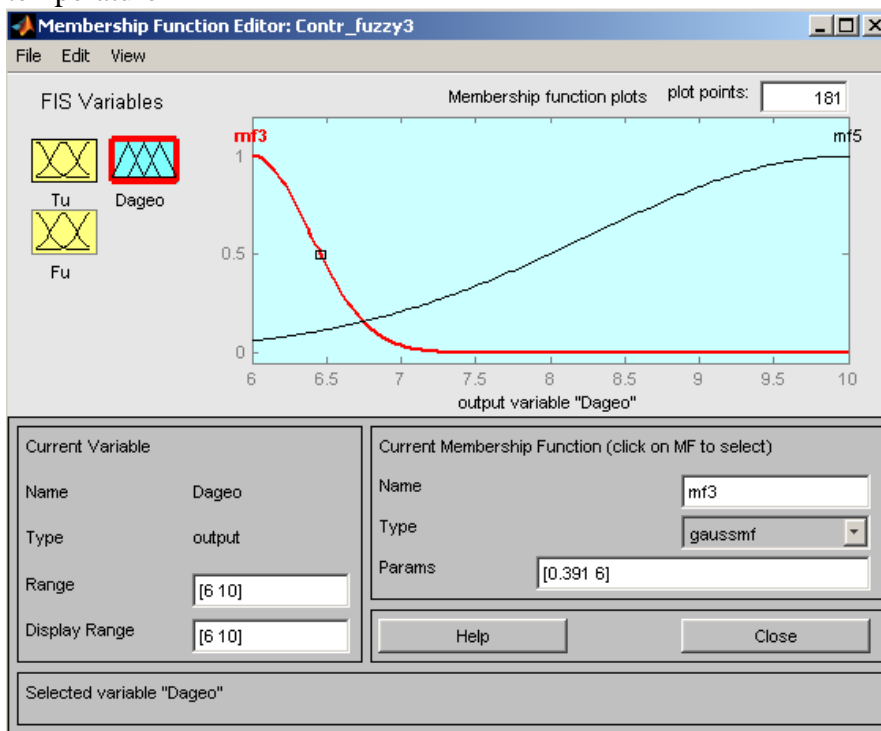Fig. 6. Funcţii de apartenenţă de intrare pentru fluxul termic

Figure 7. The output membership functions for geothermal water flow

CONCLUSIONS

It is observed that PIDşi fuzzy systems tested and give good results through the development of PID and fuzzy models can be tested and other inference with membership functions and different rules. The interface for editing the rules shown in Figure 8

In accordance with the general situation, control logic fuzzy can be developed convenient.
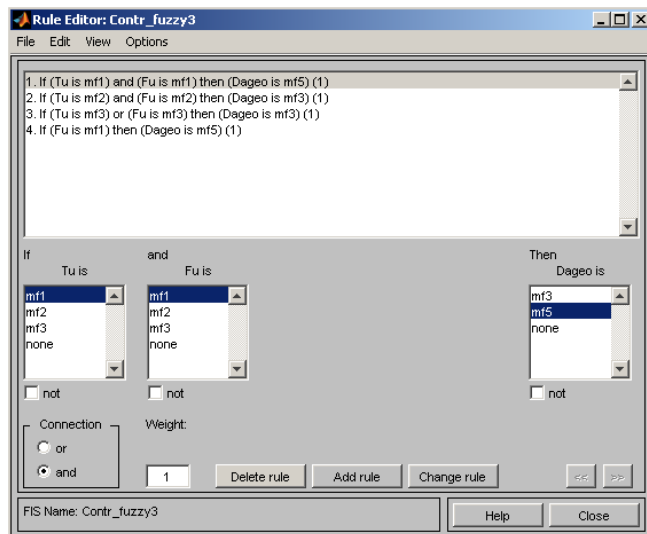
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Fig. 8. Viewing a set of rules

Automatic control system PID and fuzzy greater productivity, equipment and its performance directly affects the quality of the product and the benefits of the whole processing of agro-food product.

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