MODELING THE REGULATION OF THE MALT DRYING WITH GEOTHERMAL WATER USING FUZZY CONTROLLER

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Abstract
This paper has proposed the strategy of driving simulation system for drying malt by adjusting the temperature and heat flow malt dryer, using fuzzy controller. The simulation results showed that the performance management system with fuzzy controller to the classic system of drying, dry malt increase productivity by increasing speed of response and the controller's stability.

Key words: controller fuzzy, geothermal water, malt drying

INTRODUCTION

It is known that in recent years, beer consumption has increased dramatically, particularly in the last ten years. Malting barley production increased due to the fact that more and more farmers began to plant barley, which is the main ingredient of beer production?

Drying malt geothermal water decreases overhead costs by approximately 30%. This article will present modeling leadership malt drying system with fuzzy controller by using geothermal water. Adjust the temperature and heat flow from the dryer.

MATERIALS AND METHODS

If control (Astrom, 2002,) study drying system characteristics required to develop a model able to simulate the operation of the dryer heat exchangers and malt, (López and Iguaz, 2007) their thermodynamic characteristics. This was decided using a simulation program by which to define the heat (conduction, convection, temperature and renewable sources of heat flux) and links between them. Thermal processes are related to the model so as to reflect the actual system characteristics.

MATLAB programming environment uses a programming language for high level technical and interactive development environment for developing algorithms, data analysis and visualization and numerical computation.

Simscape program is itself a model development environment based on block diagrams for the design and simulation of mechanical components assemblies, hydraulic, pneumatic and thermal. (Danfoss, 1986) Of these model systems were chosen conponentele drying heat. In this program you can specify for each component of the mass (inertia) thermal conductivity and convection coefficient, temperature and heat flux sources. Heating elements in the model are represented by functional blocks that can be interconnected so as to fairly represent the modeled processes. The computing platform is part of Simscape Physical Simulink Modeling, which operates in conjunction with Simulink and MATLAB programming environment. If they performed math Simulink blocks operating on values representing signals and when Simscape blocks, they operate with physical quantities. And Simscape Simulink blocks (Volosencu, 1997) can be interconnected in the same model using special interface blocks.

For the development of functional model was chosen MATLAB programming environment (MathWorks Company) which includes a series of product software (Simulink, Simscape) and gives a high flexibility, proper modeling problems can be expressed by systems of ordinary differential equations.

The aim is to establish simulation caractersticilor drying system and the definition of control components that will help improve these characteristics. (Gonzale and Odloak., 2006)

Figure 1 presents the general scheme of the drying system. In the model, defined by geothermal water flow rate (Debit_apa_geo) and temperature (Temp_apa_geo). Sizes are characteristic of geothermal water inflows for the group three heat exchangers in series.(Bara, 2001, Zanoelo, 2008)

Exiting the group changing (Jover, 2006,) the temperature of the heated air (Te_aer) representing an entry in the subsystem drying (dryer). As input into the dryer is defined initial temperature of the wet malt (Tinit_malt) and flow malt (Debit_malt).

Cold air is represented by the sum of the average air temperature (Temp_medie_aer) and a sinusoidal variation (Var_temp_aer), modeling the temperature variation with amplitude of 5 degrees Celsius for 24 hours (3600x24 seconds).

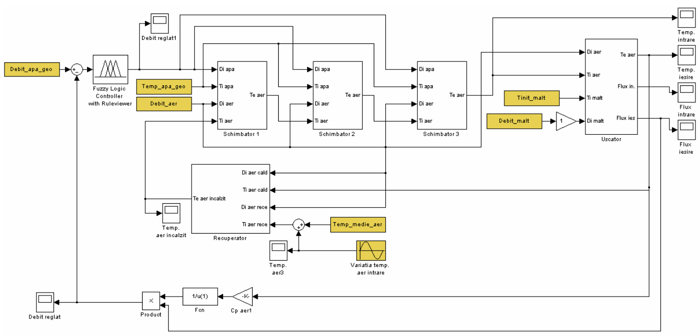

Fig. 1. The general scheme of management of the malt drying system with geothermal water using fuzzy controller

These characteristics of cold air is input to the heat recovery subsystem in the air leaving the dryer fails to heat the cold air pumped into recuperator. (K. Leiviskä, L. Yliniemi, 2005,)

System sizes are monitoring temperatures and heat flows in different phases of the process represented by blocks (Javier A.Villegas, Stephen R.Duncan., 2009) view diagrams of events (such as input Temp Flux input, etc..). Each subsystem of Fig.1 or scheme includes a lower hierarchical level.

RESULTS AND DISCUSSION

Monitoring system sizes are heat flows and temperatures in different phases of the process represented by blocks view diagrams of events (such as Temp Input, input flow, etc.). Monitoring may be adjusting fuzzy while viewing the simulation through the graphical user interface shown in Figure 2.

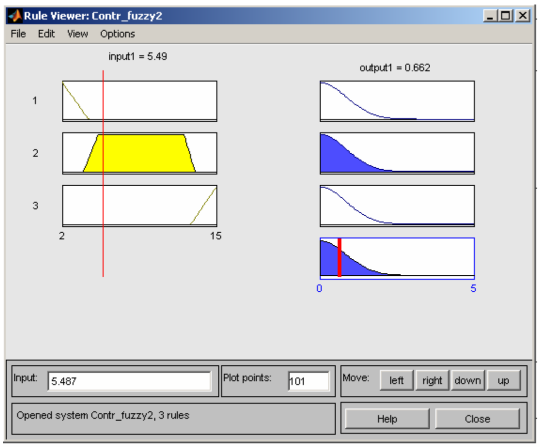

Fig. 2. View drying monitoring management system with fuzzy controller

The simulation results presented as control charts quantities (temperature and heat flow out of the dryer) in Figures 3 and 4.

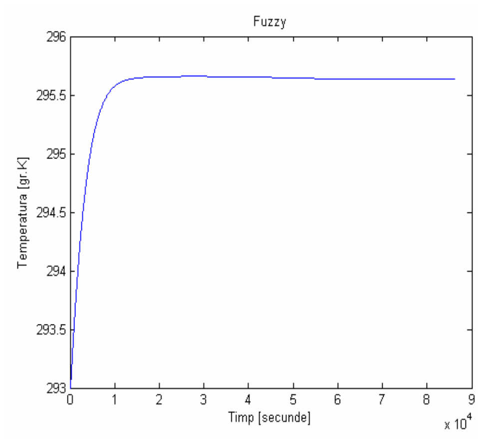

Fig. 3. Diagram from the dryer outlet temperature

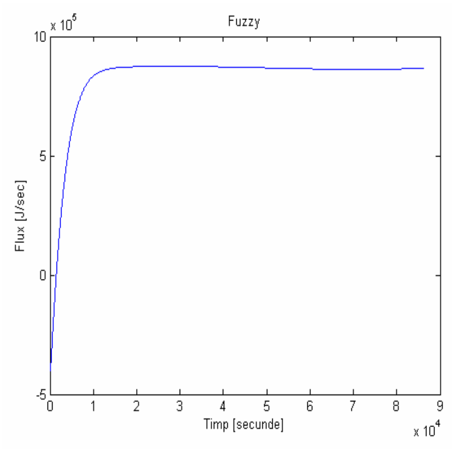

Fig. 4. Output flow diagram of the dryer

The chart shows an increase in productivity by 1.3 hours before drying system PID.

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