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THEORETICAL BASIS AND EFFICIENCY OF AUTOMATED MANAGEMENT SYSTEMS IN FOOD MANUFACTURING ENTERPRISES

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Mirzayev Jasur Validjonovich
Researcher

Abstract

This in the article food in the industry applicable automated management theoretical knowledge of systems (PLC and SCADA) basics , functional structure and working release to the efficiency impact wide analysis Technological processes mathematician modeling , real time monitoring in mode and management algorithms importance illuminated . Automation economic and technological efficiency scientific basically statement done .

Keywords

automation , PLC, SCADA, control theory , technological process , PID controller , digital monitoring.

Login

Modern food industry high quality , safety and sanitation requirements answer to give necessary . Technological of processes complication and working release size increase as a result at hand management methods ineffective become is going on . This because of automated management systems (ABT) developed of release inseparable to the part has become .

Automation not only working release stability provides , but human factor the impact reduces energy and raw material spending optimizes .

Automation theoretical basics

Automatic management theory technological of the object entrance and exit parameters binder mathematician to the model is based on . Every how management system following main from elements organization finds :

- Managed object
- Measurement devices (sensors)
- Regulator
- Execution mechanisms
- Information transmission system

Management system general model

Exit signal as follows is expressed as :

$$Y(t) = G(s) \cdot U(t)$$

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This on the ground :

- $G(s)$– transfer function of the object
- $U(t)$– input signal
- $Y(t)$– output parameter

Food in the industry controllable parameters the following to be possible :

- Temperature
- Pressure
- Liquid level
- Bleaching time
- Bleaching intensity

PLC systems work principle

PLC (Programmable Logic Controller) - industry under the circumstances to work intended microprocessor management is a device .

PLC 's main blocks :

1. Central processor (CPU)
2. Login modules
3. Exit modules
4. Power source
5. Contact interface

PLC following algorithm based on works :

1. From sensors information acceptance to do
2. Program based on analysis to do
3. Decision acceptance to do
4. Execution to the mechanisms alarm send

PID regulator theory

Many food PID controller in processes applies to :

$$U(t) = K_p e(t) + K_i \int e(t)dt + K_d \frac{de(t)}{dt}$$

This on the ground :

- K_p– proportional coefficient
- K_i– integral coefficient
- K_d– differential coefficient
- $e(t)$– error signal

PID regulator the temperature stable important in preservation (e.g. , pasteurization) importance has .

SCADA systems functional opportunities

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SCADA (Supervisory Control and Data Acquisition) system centralized monitoring and control is a platform .

SCADA system main tasks :

- Real time in mode monitoring
- Process parameters graphic in appearance to describe
- Data archiving
- Accident alarm
- Remote management

SCADA system with PLC integrated without The PLC runs the process . controls , and SCADA him/her visual control does .

Food in the industry automation application

Automated systems following in the fields wide applies to :

- Milk pasteurization to do
- Juice working release lines
- Canned food sterilization
- Dough mixing processes
- Packaging lines

For example , milk pasteurization in doing temperature between 72–75°C strict control is done . Via PLC temperature sensor signal again processed and heating system automatic managed .

Economic and technological efficiency

Automation as a result :

- Product quality stabilizes
- Energy expense decreases
- Malfunctions number shrinks
- Production release speed increases
- Sanitation requirements improves

Scientific research this shows that completely automated on the lines working release efficiency up to 20–35% increases .

Digital transformation and Industry 4.0

Modern food in enterprises :

- IoT sensors
- Cloudy information base
- Artificial intellect based on forecast systems
- Energy monitoring platforms

current is being done .

This is smart working (Smart Factory) concept shapes .

Conclusion

Automated management systems food industry stable in development strategic importance has . Theoretically management systems mathematician modeling and transmission to the functions PLC and SCADA integration technological processes in real time in mode accuracy with management opportunity gives .

PID regulators using process parameters at optimal levels storage It is possible . This is product of quality one kind to be , energy thrift and working release safety provides .

In the future food in the industry artificial intelligence , digital monitoring and remote management systems further wide current to be is expected . This and industry complete digital to the transformation take is coming .

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