FREQUENCY CONTROL OF BELT CONVEYOR SPEED IN MANUFACTURING FOOD

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ABSTRACT

The text describes a physical model of a belt conveyor with an advanced control system. It highlights features such as cargo positioning control, height monitoring, basket fullness control, and belt speed management. The system employs optical sensors and movement detectors to ensure precise and efficient operation. The comprehensive control strategy enhances the overall functionality of the conveyor, making it a sophisticated laboratory installation for studying and optimizing material transport processes.

Keywords: Belt Conveyor Model, Drive Motor, Optical Monitoring, Receiving Baskets, Turntable, Control System, Cargo Positioning, Height Control, Basket Fullness, Belt Speed, Optosensor, Tape Slippage, Laser Beams, Movement Sensors, Rotating Mirror, Laboratory Installation.

INTRODUCTION

The physical model of a belt conveyor is an installation with a transport belt driven by a drive drum, which in turn rotates from a drive motor. Above the belt is an optical system for monitoring the dimensions of the transported goods and their height. At the end of the transport track there are two receiving baskets, which are designed to receive conditionally both high and low loads that are dropped by the turntable.[1] The choice of direction to dump into a particular basket is determined by the control system. There are also cargo weight sensors under each basket. An introductory sketch of the laboratory installation of the belt conveyor is shown in Fig. 1.

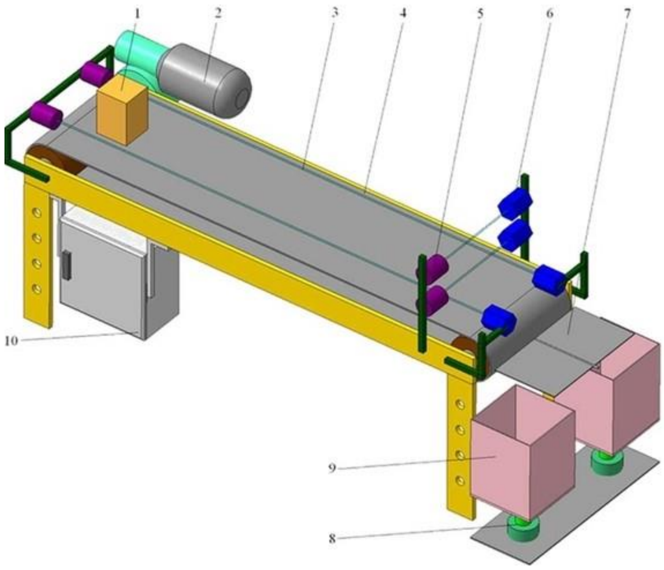

Figure 1. Physical model of the conveyor: 1-transported cargo; 2-asynchronous electric motor; 3-light beam; 4-belt; 5-light source; 6-optosensor; 7 – guide turntable for lowering loads into baskets 9; 8-motion sensors for measuring the weight of loads; 9-receiving stations cargo collection baskets; 10-power cabinet with electrical equipment

LITERATURE REVIEW

The physical model management system uses the following control implementations:

1. Control of cargo positioning along the width of the belt. It is implemented using laser beams on the sides along the tape[2].

2. Control of the set height of the transported goods by using two light beams at two different heights across the direction of movement of the belt.

3. Control of the fullness of baskets with loads using 2 movement sensors.

4. Belt speed controlоптодатчик, a speed optosensor is installed on the slave drum. The sensor counts the number of light pulses through the rotating mirror, also measuring the duration between pulses[3].

5. Control of tape slippage relative to the master drum is implemented by comparing the speeds of the master drum and the tape. At the same time, a mirror is also installed on the drive drum to reflect light to the optosensor.

METHODS

The control program is shown in Fig. 2.

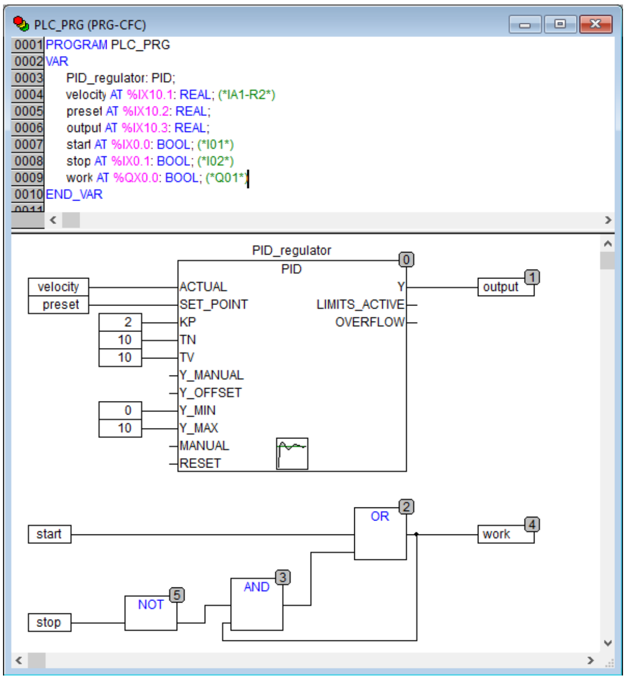

Figure 2. Diagram of a belt conveyor in the CoDeSys environment

Symbols for input and output signals:

velocity - the speed measured from the belt speed sensor on the conveyor

preset - уставкаspeed setpoint

start - start variable

stop - stop variable

work-variable for switching on the conveyor belt drive motor

output - variable of regulating influence for the frequency converter for the purpose of controlling the speed of rotation of the drive motor.

Symbols on the PID controller:

KP - proportional coefficient

TN - time constant of the integrating link

TV - time constant of the differentiating link

Y_MIN, Y_MAX - regulatory impact limits Y

Communication between the CoDeSys control system and the electric conveyor drive

The controller's start and stop buttons and corresponding program variables start and stop are associated with the physical input of the controllerstop.

Velocity variables are associated with the analog input of the controllervelocity, and a signal from the speed sensor is sent to this analog input of the speed meter.

This is an analog signal from the PID controller.

This analog signal is fed to a frequency converter that directly controls the speed of the motor's electric drive[4].

The process of turning on the engine itself is carried out by applying a signal from the work variable.

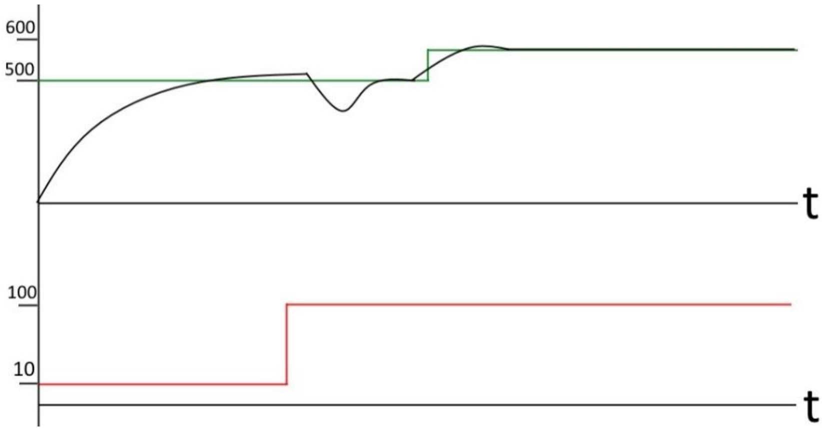

Figure 3. Plot of уставкиspeed setpoint (green),rotation speed (black) and load (red) versus time

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