AUTOTUNING CONTROL DESIGN FOR HEAT EXCHANGER-TYPE PLANT WITH TIME DELAY

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An air-conditioning system nowadays represents a technological unit composed of individual components and controlled by integrated control unit, which is often a part of higher control system. There is always a heat exchanger on basic level, and on its correct functioning and controlling directly depends the efficiency as the main factor, if it comes to energy savings.

In the study is presented the autotuning control method set to control a cross-flow heat exchanger. The cross-flow air-to-air heat exchanger was made as prototype designed to serve as a unit which is a complementary to the pre-heater installed in air-supply duct onto the air-conditioned space. Into the exchanger flows the fresh air, which could be prior the entry pre-heated depending on the outdoor climatic conditions. The duct is inside the exchanger filled with the set of fine tubes made from special plastics of low specific heat capacity. The supplying air flows through the tubes and leaves them out from fines and exchanger on the opposite site of exchanger. The indoor air leaving the controlled space returns back to the exchanger. Therefore, the heat warms the tubes and the axial heat transfer occurs along each tube. The control task consists essentially from few variables: 1. fresh air volume rate, 2. returning (warmed) air volume rate, heat transfer efficiency and hygienic restraints (CO_2-concentration level, maximal air velocity within occupancy zone), Fig. 1:

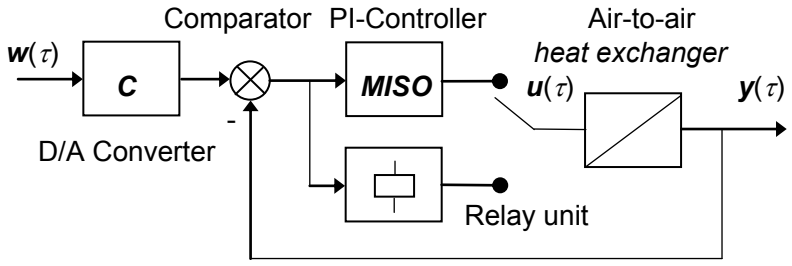

Fig. 1: Bloc scheme of a relay automatic tuning PI-controller in closed loop control with the air-to-air heat exchanger.

The MISO-controller (multiple-input-single output) exercises PI (proportional-integral) algorithm until the hygienic constraint is reached in tuning or control mode, then would keep the maximal allowed hygienic value of CO_2-concentration level through the output quantity, returning (warmed) air volume rate.

Keywords:

Controller tuning, heat transfer efficiency, air volume rate, simulation model.

References:

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