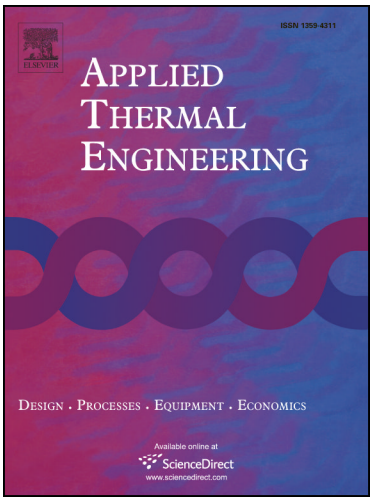

Research Paper

An investigation of air and water dual adjustment decoupling control of surface heat exchanger

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An investigation of air and water dual adjustment decoupling control of surface heat exchanger

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Abstract: The terminal equipment of central cooling system accounts for a significant proportion of the total system's energy consumption. Therefore, it is important to reduce the terminal equipment energy consumption in central air conditioning system. In this study, the difference of the effect of the chilled water flow rate and air supply rate on the surface cooler during the heat transfer process is taken into full account. Matlab/Simulink simulation software is used to model and simulate the heat transfer of surface cooler of the main terminal equipment of air conditioning system. Simulation tests and experimental validations are conducted by using variable chilled water flow rate and variable air supply rate control mode separately. The experiment results show that the simulation model can effectively predict the heat transfer performance of heat exchanger. Further, the study introduced a dual feedback control mode, which synchronously regulates the chilled water flow rate and air supply rate. Also, under certain conditions, the complex heat transfer process of the surface cooler can be decoupled, and single variable control pattern is used to separately regulate the chilled water flow rate and air supply rate. This can effectively shorten the system regulation time, reduce overshoot and improve control performance.

Keywords: Central air-conditioning; heat exchanger; Simulation; Decoupling Control; Energy saving

Nomenclature

HVAC	Heating, ventilation and air conditioning	d	Humidity rate, g/kg
AC	Air conditioning	φ	Relative humidity %
VAV	Variable air volume	P_v	Partial vapor pressure
VRF	Variable refrigerant flow	E_w	Efficiency of water side
DDC	Direct Digital Control	a, b, c	Experimental exponents