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Analysis of the Cooling Tower Ventilator in the MATLAB Software

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Abstract:
The article presents analytical data on water resources in Uzbekistan and other countries. Based on the system of artificial intelligence, opinions were expressed about the preservation of water resources and the ecosystem in it. Considerations on the wise use of water resources using artificial intelligence, deterministic - stochastic models are presented

Keywords: water, resource, ecosystem, agriculture , smart use, artificial intelligence

1. Introduction

Mathematical modeling of the process of water cooling in an open-type heat exchange-fan cooler is based on the system of equations for calculating the water temperature in the quasi-element [1,2]. We write a system of equations that allows us to determine the parameters of cooling processes:

When choosing watering devices, such indicators as the degree of cooling and the price of the cooling tower should be compared, attention should be paid to the loss of pressure in the respiratory tract, the strength of the material of the watering device, ease of installation and maintenance [3].

$$t_i = \frac{(G_{j+1} * c * t_{j+1} - \Delta G_i + \alpha * F * t_{B.j-1})}{\left(\left(G_0 - \sum_{j-n}^{j} \Delta G\right) * c + \alpha * F\right)} \tag{1}$$

$$X_j = \beta_j * F_j\left(X^* - X_{j-1}\right)/m_j; \tag{2}$$

$$\Delta G_B = G_{B\,j-1}\left(X_{j-1} - X_j\right); \tag{3}$$

here,

$$X^* = \frac{P}{P_0}; \tag{4}$$

$$P = P_0 * X_{j-1}^{*M}; \tag{5}$$

$$G_0; = \frac{G_B}{X_0}. \tag{6}$$

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Algorithmization of equations was carried out, which helps to solve the system of equations. Based on such algorithmization, a computer model was formed. The computer model implemented as a Windows application is considered a multi-program complex, it includes a local database and a graphical user interface developed in the Visual Basic environment, as well as a calculation core and a graphical conclusion in the Matlab environment. The computer model mathematically expresses the geometry of the nozzle, its heat-mass exchange characteristics [1,4,5,6].

Due to the possibility of independent modification of the code of software blocks in order to take into account changes, it has a modular structure designed to carry out optimized calculations and search for alternative options [1,7].

Or, using the concept of variables in the MATLAB application program, we create the following expression

$$((u(3)*4.19*u(1))+Ktv*f*(u(4)-u(5))-(u(2)*2519))/((u(3)*4.19)+(u(2)*1.8)) \quad (7)$$

2. Results and Discussion

Calculations of process indicators in open-type heat exchange-pump fan cooling tower require the determination of equilibrium conditions in heat-mass exchanges with the air phase of the water phase. Here, the vagaries and equilibrium concentrations of moisture in the air are determined.

Algorithmization of calculation of water temperature in the open-type heat exchange-nozzle fan cooler was performed using the capabilities of the MATLAB application program. Based on such algorithmization, a computer model was formed [2,4]. Based on the computer model of the dynamic processes of water cooling in the open-type heat exchange-tube fan cooling tower, based on the combination of the material balance of the system and block models, a computer model of the open-type heat exchange-tube fan cooling tower was created, in which the water and air temperatures are regulated (Fig. 1).

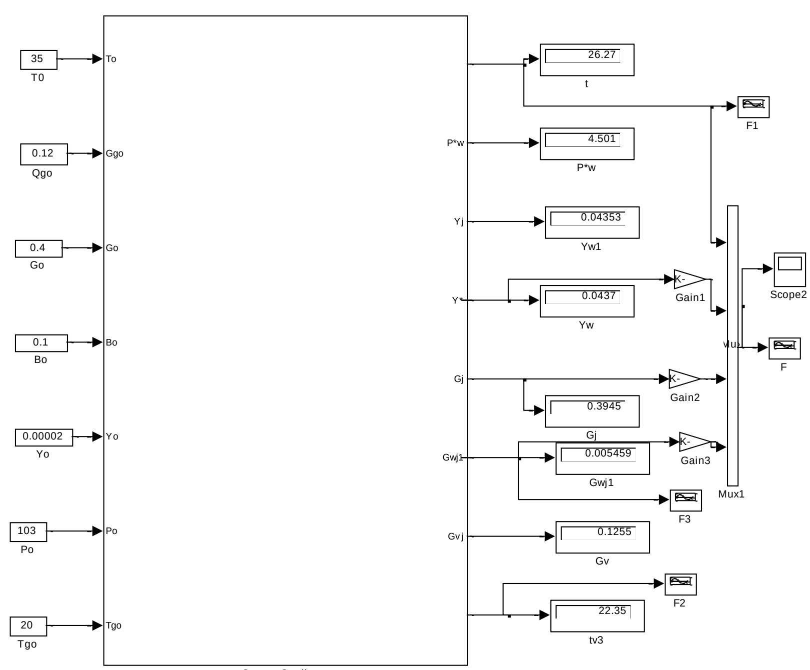

Figure 1. A computer model of a heat exchange tube quasi-apparatus of an open-type fan cooler

The input parameters of the computer model of the heat-mass exchange processes in the heat exchange quasi-apparatus are as follows: initial consumption of incoming air, initial temperatures of water and air, pressure in the device Ro, liquid consumption Go, initial air humidity. Output parameters: display air consumption at the outlet, display temperature T, device pressure P, liquid consumption G.

$$G_{g0}T_0\ Y_oG_g \tag{8}$$

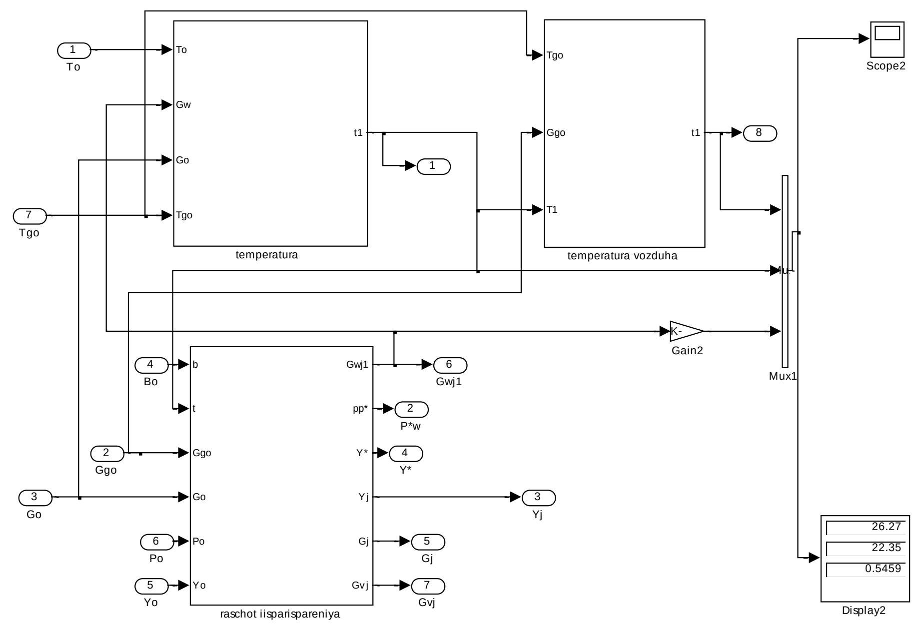

Figure 2. Elements of the computer model of the process in the quasi-apparatus of the open-type heat exchange-tube fan cooler

1) unit for calculating the liquid temperature in the heat exchange tube;
2) air temperature calculation unit; block for calculating mass exchange and equilibrium conditions

Figure 2 shows the elements of the computer model of the process in the quasi-apparatus of the open-type heat exchange-nozzle fan cooler: elements of the computer model: the unit for calculating the heat-mass exchange of the liquid temperature in the heat exchange-nozzle tube; air temperature calculation unit; block of calculation of mass exchange and equilibrium conditions. The calculation of heat-mass exchange between the liquid and air phases includes three blocks and a number of elements, recording the necessary output parameters [2,5,6,7].

If the air temperature is 300 C, the air temperature in the heat exchanger tube will stop growing at 310 C. So, if the temperature of the air is lower than the temperature of the water, the temperature increases with time.

As can be seen in Figure 3 below, in the dynamics of the process start-up in the heat exchange tube of the heat exchange tube quasi-apparatus, the time dependence of the air temperature decreases to the set state.

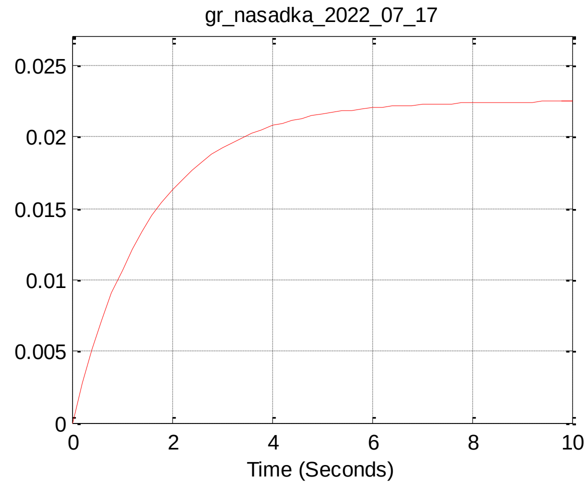

Figure 3. Time transition process graph of water to air evaporation consumption in the heat exchange-tube quasi-apparatus of the open-type heat exchange-tube fan cooler

Figure 3 shows the transition process curve of time dependence of water evaporating into the air in a quasi-apparatus with an open type heat exchange-nozzle fan. Over time, the dynamics of the consumption of water evaporating into the air increases up to the specified state [11,12,14].

3. Conclusion

In the computer model of the heat exchanger-pump zone of the open type heat exchanger-pump fan cooling tower, it can be seen by calculating the water-cooling process, in the transition process curve of the time dependence of the temperature, in the process dynamics, the water temperature decreases to the specified state. Also, the curvature of the transition process of the time dependence of the air temperature indicates that in the dynamics of the process, the temperature decreases to the specified state. The consumption of evaporating water in the air, on the other hand, increases over time to a certain state in the heat exchange-pump.

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