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OUTDOOR AIR INFLUENCE TASK UNIT FOR SIMULATION MODELING OF AUTOMATED CONTROL OF HEATING AND CONDITIONING SYSTEMS

The use of heat pumps is one of the most energy efficient ways of heating residential and industrial premises. The cost of electricity to drive a heat pump is usually lower than the cost of gas in a boiler plant, both in energy equivalent (reduced to conventional fuel) and in money [1-3].

The purpose of the work is to study the influence of the control effects of the system on the output variables, in order to minimize energy consumption while maintaining a given mode of operation.

The use of simulation to study the results of the proposed system allows to qualitatively determine the temperature deviation inside the building. This raises the question of how to set the change in ambient temperature for the entire period of simulation, which lasts a calendar year.

The reference temperature is the reference average statistical temperature value for the climatic region in which the location of the simulation object is allowed. A vector of twelve values is formed, one for each month. Statistics for each individual month are also used to take into account daily temperature fluctuations.

Simulink assembles a cascade, which is shown in Figures 1 and 2. For the simulation time, which is calculated hourly, the corresponding blocks are changed with the set temperatures and deviations for each month. At the output of this subsystem we have only one parameter - the value of the outside air temperature for a given hour. Cascade blocks are switched using logic elements that track the current value of the time variable.

Figure 3 (lower graph) shows an enlarged interval of the graph for the month of May, which shows the change in temperature over time outside and inside the building. The upper graph shows the change in heating and air conditioning costs. If necessary, it is possible to set the temperature changes even more precisely for a certain zone, splitting the time into more intervals. But as practice shows, when using the average values for the month, the accuracy of such grinding almost does not increase.

The use of such a cascade allows you to specify in the simulation model the annual climatic effects for any geographical location of the object under study. In this case, we have the opportunity to choose the beginning and end of the time zone of the simulation, in accordance with the technical problems to be solved. The advantages of the developed subsystem include reliability and flexible configuration. The disadvantages include some cumbersomeness of the block diagram.

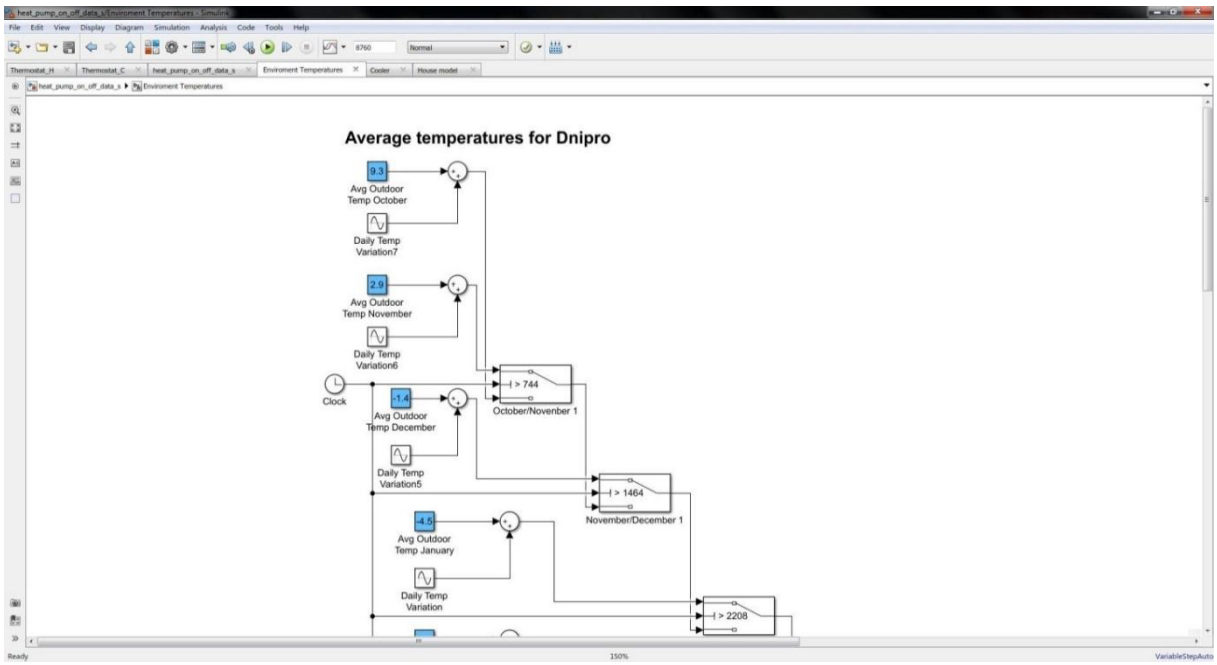

Figure 1 – The beginning of the cascade of blocks of the subsystem of simulation of external climatic influence

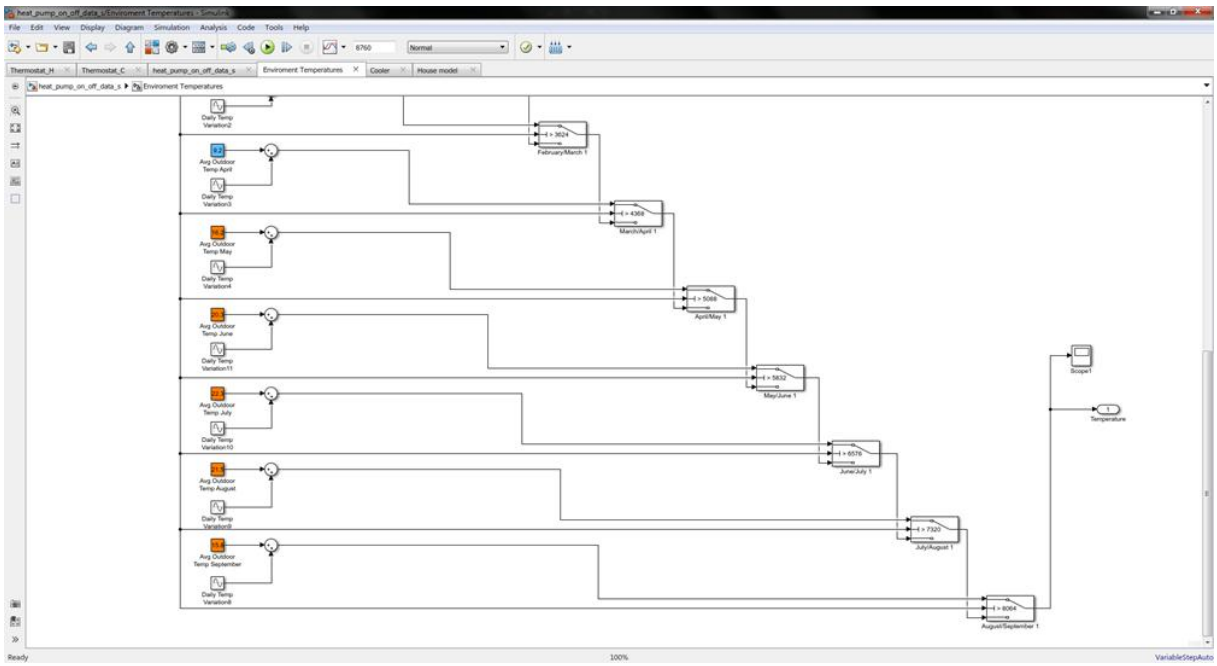

Figure 2 – Completion of the cascade of blocks of the subsystem of simulation of external climatic influence

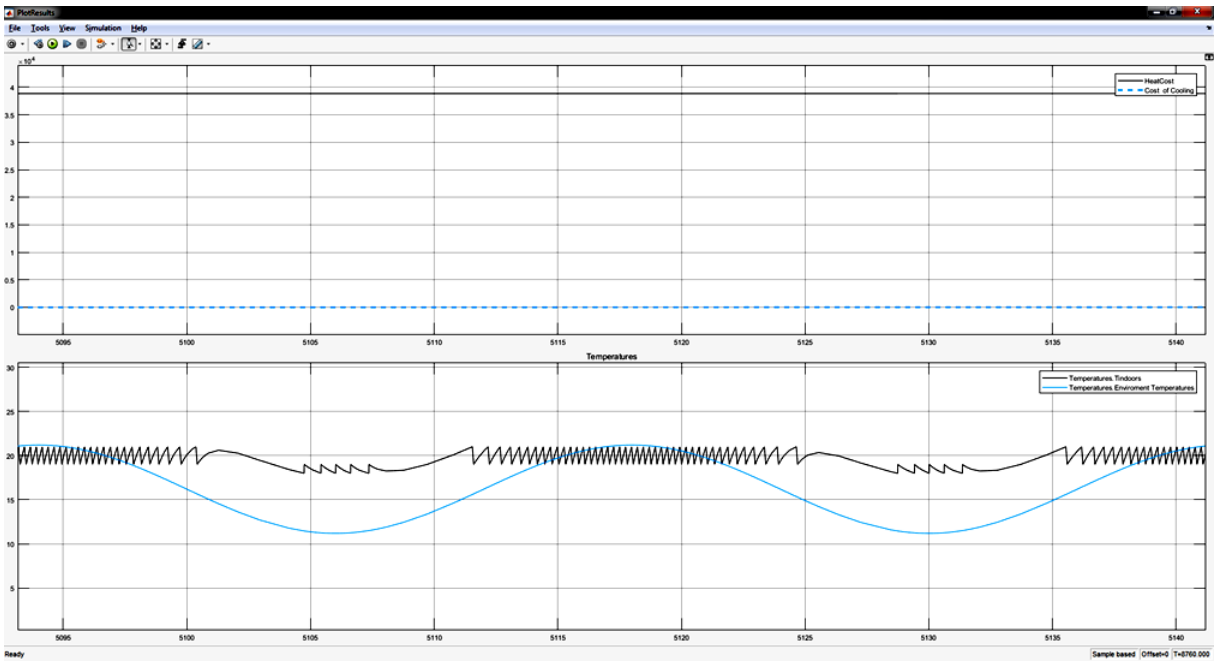

Figure 3 – Interval of the temperature graph inside the building (black graph) and outside (blue graph). Taken in May, for $t_H = 22°C$, $t_C = 20°C$

References

1. Олишевский И. Г. Обоснование метода утилизации теплоты системы кондиционирования для теплонасосной системы отопления / Г. С. Олишевский, И. Г. Олишевский // Інформаційні системи, механіка та керування / НТУУ «Київський політехнічний інститут». – Київ. – 2017. – № 17. – С. 86 – 94.

2. Олішевський І.Г. Автоматизована методика розрахунку параметрів для нетрадиційних технологій опалення та кондиціонування будівель/ І.Г. Олішевський, Г.С. Олішевський // Електротехніка та електроенергетика. / Запорізький нац. ун-т «Запорізька політехніка». – Запоріжжя, 2021. – № 3. – С. 40-47. URL: http://ee.zntu.edu.ua/issue/view/14721

3. Олишевский И. Г. Обоснование рациональной схемы теплонасосной системы отопления / И. Г. Олишевский // Механіка гіроскопічних систем / НТУУ «Київський політехнічний інститут». – Київ. – 2015. – № 30. – С. 26 – 35.