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«Advanced Technologies in Aerospace, Mechanical and Automation Engineering» MIST: Aerospace – 2019

«Analysis of modern approaches for maintaining a comfortable microclimate in the buildings»

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Introduction

- This paper identifies the technical and economic aspects of application of intelligent technologies to maintain a comfortable indoor microclimate on the basis of statistical data. In the process of studying works of foreign authors, examples of the climate control systems are considered, which are developed based on the use of various intelligent technologies (fuzzy systems, neural networks, neuro-fuzzy modeling). The results of analysis has revealed the advantages and disadvantages of the given control systems and has defined promising further directions.

Technical and economic aspects of application of intelligent technologies to maintain a comfortable indoor microclimate

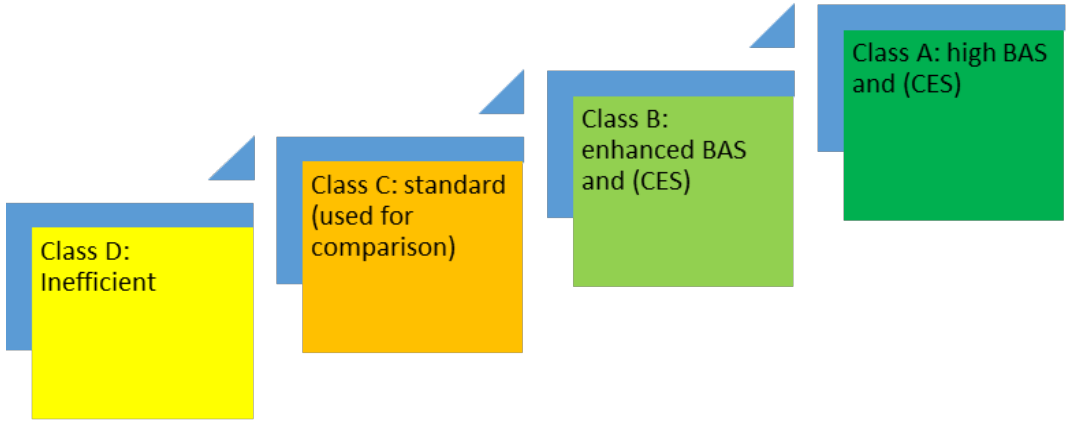

Figure 2. Classes of energy characteristics of automation systems
(BAS - building automation systems; CES - control of engineering systems)

In accordance with European Norm EN 15232 and Russian standard - GOST P 54862-2011, building automation systems and control methods of engineering systems are divided into four classes of energy efficiency: A, B, C and D (Figure 2).
Class D includes energy inefficient building automation systems and control methods of engineering systems, which should not be applied in the design decisions. The class C is called the standard or comparative. Power consumption in engineering systems, automated and controlled by the class C, is conventionally taken as a unit for comparison. Class B includes systems with enhanced energy efficiency and Class A is the highest energy efficiency.

Technical and economic aspects of application of intelligent technologies to maintain a comfortable indoor microclimate

	Automation of heating systems	D	C	B	A
0	Automatic temperature regulation in the central heating unit.				
1	Automatic temperature regulation in the individual heating units.				
2	Individual room temperature control (radiator valves, thermostats, etc.).				
3	Individual room control with communication between the controllers and the central station.				
4	Individual room control with communication and consideration of human presence conditions.				

Table 1. Automation systems of heating for different classes.

As it can be seen from Table 1, if automatic adjustment of the heating temperature is limited to central heating unit, then the system corresponds to the inefficient Class D, since heat transfer agent of one temperature is supplied to different buildings with different thermal characteristics and different heating requirements. If automatic temperature regulation of heating is limited to individual heating units (IHU), the system also corresponds to the Class D, since the heat transfer agent delivers the same temperature to different rooms of a building with different heating requirements. In order to meet at least Class C standard, it is necessary to provide individual room temperature regulation at least with one of the following methods: radiator valves, thermostats, room controllers. For meeting the Class B standards, it is required to organize individual room temperature regulation with communication between the controllers and the central station. Communication in the form of a feedback loop allows introducing an additional potential of saving in the heating system. Finally, to comply with the Class A standards, it is necessary to provide individual room temperature regulation with communication between controllers and central control station in addition to human presence control in the room.

Analysis of modern approaches to maintain a comfortable microclimate in buildings

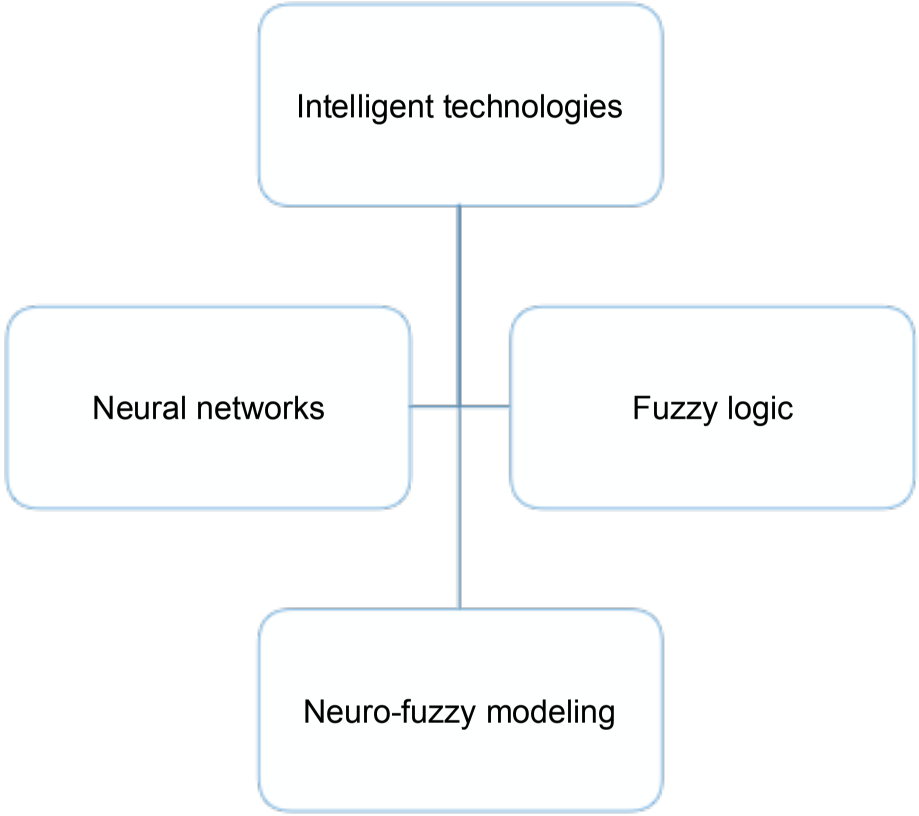

Figure 3. Intelligent technologies.

Conclusions

Results, implementation

- Based on the conducted analysis it has been identified that there are various control technologies of microclimate parameters in the room. In order to maintain the parameters of nonlinear systems with dynamically changing parameters, as well as when there is no a priori information about the control object or it is incomplete, the use of intelligent technologies such as neural networks, fuzzy logic controller, neuro-fuzzy systems is effective

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