UDK: 004.896:004.4 COBISS.SR-ID 228338188 **Review Article**

KNOWLEDGE - BASED COMPONENTS OF COMPUTER-AIDED DESIGN FOR ENGINEERING HEATING NETWORKS

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***Summary**: Now there is a functional extension of computer-aided design (CAD), which allows you to implement new features. One of these solutions is the prediction of the state utilities, including heat, through the use of intelligent components of the automated systems. Functionality aimed at modeling of processes in engineering networks and objectives for energy efficiency, detection of problem areas, identify the irrational arrangement of heaters and others.*

***Keywords**: CAD, intelligent components, engineering thermal networks, automation, energy efficiency, thermal physics, forecasting, modeling processes.*

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1 INTRODUCTION

The problem of the distribution of heat in the heating elements of engineering networks, as well as detection of problem areas are now among the most time-consuming tasks requiring the use of intelligent automation components based on existing CAD. Intelligent components CAD implemented software modules using fuzzy logic, and focus on the use of the knowledge base of frame architecture [1] In the intellectual environment uses media interface (MI), the use of which there is an exception error in the calculation of heat flows and the elimination of the situation with two possible embodiments. The effectiveness of MI can be guaranteed the implementation of algorithms for classification and identification of situations, predicting their development in real time, as well as timely synthesis of actual descriptions of the behavior of the system in a variety of cases. MI is implemented on the basis of algorithms for imaging heat flow prediction of freezing the building structure, layout heaters; detect problem areas in the sewer networks, as well as algorithms to identify patterns of baseline data on the temperature readings.

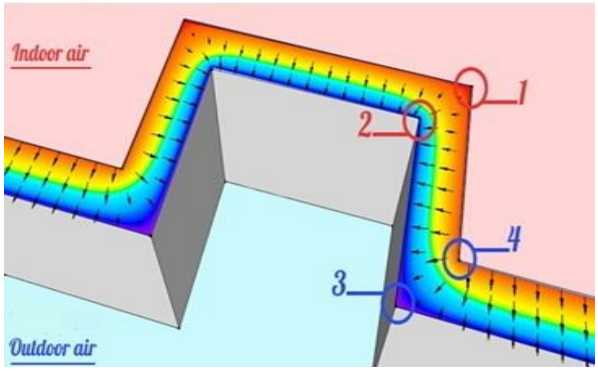
2 VISUALIZATION OF HEAT FLOW

Component visualization of heat flows utilities.

At the initial stage of the algorithm takes the form analysis of changes in the thermal circuit (TC), which is initialized in the team to change the settings. When initializing is performed to detect the temperature sensors and the formation of the data samples. Based on the temperature data samples occurs recognition situation: the presence or absence of problem zones. The

method of recognition of the situation lies in the ability to set ambient temperature conditions outside the contour, as well as granting councils in the case where the heat flux from the heater can heat the entire path. Problematic areas (PA) in this case will be considered the region in which the effect is minimal and insufficient heaters for heating engineering network or part of the air flow in the room.

Examples of imaging detection of problem areas and the colors of heat fluxes for various situations are shown in Figures 1 and 2:



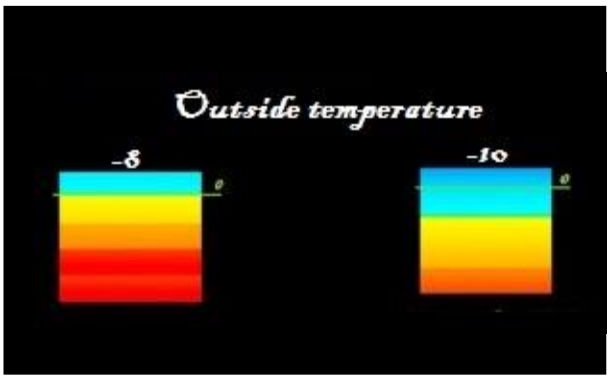


Figure 1 - *Example visualization of detected PA*

Figure 2 - *Examples of color imagin*

The main features of the visualization is, above all, clear and easy to read color gradation heat flows shown in Figure 2. In the case of overlapping heat flows from the heater and utilities they are superimposed on each other, the result of this visualization will overlay the resulting heat flux, the temperature of which corresponds to the actual temperature in the building.

3 THE ARRANGEMENT OF THE HEATING ELEMENTS

Intelligent layout algorithm TC in CAD

The task of the intellectual component [2] CAD thermal utilities, to provide the most optimal variant layout, trace a connection with the heating unit. The final step of the algorithm is to visualize the nature of heat flow to a specific situation in view of the identification algorithm situations and decision-making. The practical use of the software module using the algorithm allows using it as the design of new buildings and the reconstruction of old ones. Identifying situations thermal circuit eventually has only two options: no problem zones (zones freezing), or their availability. Identify the main steps of the algorithm identifying situations and decision-making:

Step 1. On the basis of a priori constraint matrix formed with the use of IP-linear programming techniques form the principal-WIDE intervals.
Step2. We form the matrix of restrictions contour defining the edge-tzu to heat flow.
Step3. Checking matrix "code solution" to the existence of adequate solutions
Step 4. If a solution is found, then the operation code decides on visualization heat flow in a certain way.
Step 5.If solution is not found or there are several solutions (add situation), then using a probability matrix is a solution with maximum probability.
Step 6. If the poll matrix "code solution" unique situation, absent from, in binary code relationships memory values selected the most suitable frames sector, where it is then the criterion of confidence Eden ratifies the most suitable situation.

Thus, the selection function is implemented by the new situation of choice (code binary operations) the most appropriate sector of frames in the knowledge base. [3]

Examples of rules in the Knowledge Base:

Rule 1. IF the coordinates of the distribution of the heat flow heater and the coordinates of the heat flow path of engineering networks are THEN calculate the resulting heat flow.
Rule2. IF the resulting heat flow at a temperature above the optimum THEN find the area of the problem area.
Rule 3. IF I find a problem area zone THEN build a minimal vector to the contour of utilities to find on field problem.
Rule 4. IF I find a problem area or problem area THEN you give a certificate of non-optimal arrangement and recompose again. Example visualization component layout is shown in Figure 3.

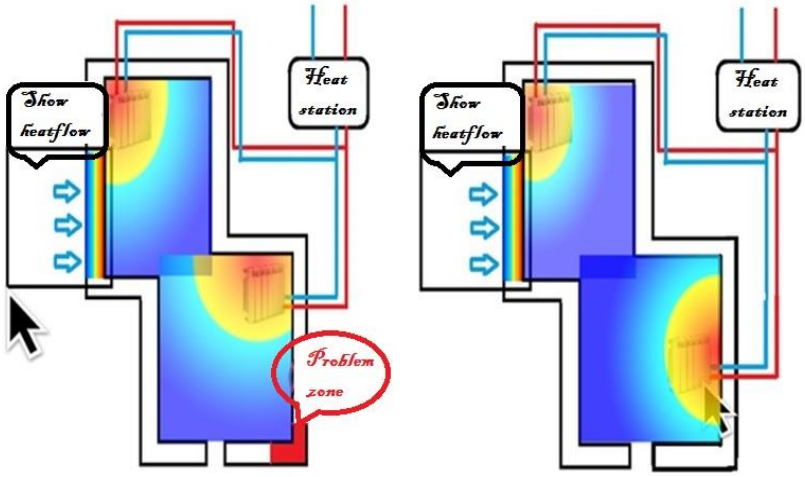


Figure 3 - *Eliminating problem areas using the component layout*

4 CONCLUSION

Application of the design of intelligent components, to avoid some of the problems related to the visualization of the data in the calculation of the CAD module to reduce the error in the calculations, and to increase the visibility of the results, as well as to provide support for decision-making in the field of building automation systems. Efficiency calculations utilities can reduce the time for calculation of parameters walls and improve their accuracy, which is an important requirement in the design of buildings and structures. The need to use these components for the CAD due to the requirement to solve the problems of distribution of thermal heating elements in the IP, as well as the need for detection of problem areas.

These tasks are currently among the most intractable in the environment of poorly formalized and demanding automation applications. The complex offers intelligent components when building CAD integration will allow more accurate visualization of the heat flows via the MI. This will increase the accuracy of calculations and impact in the future on the quality of the layout of the heating elements in the circuit utilities.

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