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HEATING SYSTEMS SOFTWARE MODELING PACKAGE

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«Mogilev Heating Systems» is the main heat supplier in Mogilev.

Nowadays the heat supply is released from heating plant №2 by a main line which runs through the heat-exchange station, to the heat electropower station, to the regional boiler rooms, and eventually to the consumers. This is all united by a single pipeline system. The «Wonderware InTouch HMI» software package developed by «Wonderware Invensys» is used to monitor heat systems in real time. The information is displayed on a monitor where the operator tracks the heat system technology modes.

The actual problem is to find the optimal operating conditions for the whole city's heating system and its single parts to deliver the required amount of heat with minimum expense to the end consumer. There are two solutions available. The first is to increase the heat carrier temperature in the system, but this increases heating costs. The second is to increase the pump usage to get higher heat carrier flow rate, but it makes the electricity costs to grow. It is possible to find an optimal solution by combining the two solutions described above.

The problem is complicated by the heat system's topology changes. These changes are associated with repairing or disconnection some of heat system parts. Accordingly, it is not possible to make a math model in the real time mode thereafter it is not possible to perform optimal management.

To optimize the heat system's operation conditions, a software package with the following features is required: modeling a heat system with any topology, determining the process variable values (pressure, heat carrier consumption and temperature), and forecasting their changes in the future under influential outdoor environmental factors (temperature, humidity, wind speed).

When designing and developing the software system, the principle of modularity is used. The software suite was divided into three separated modules that are relatively independent and easily integrated with one another. It made it possible for us to change an independent software package module implementation with minimal influence on the other components.

The first module is the graphics editor which is used to design a visual heat system topology. This module is based on the Microsoft .NET Framework 4.0 and uses Windows Presentation Foundation technology to organize a better modern user interface and data manipulation. To configure the visual heat system model representation, one must use the following primitives: the connection pipe, the valve, the pump, the heat point and the consumer with the set of para-

meters stored in a single linked list to further form the matrix data model. The user interface represented on the figure 1. A researcher can specify and modify the heat system topology, vary parameter values on the specified heat system sections and change outdoor parameter values. Consequently, this is the module that forms the heat system topology matrix to be used in other software package modules and components.

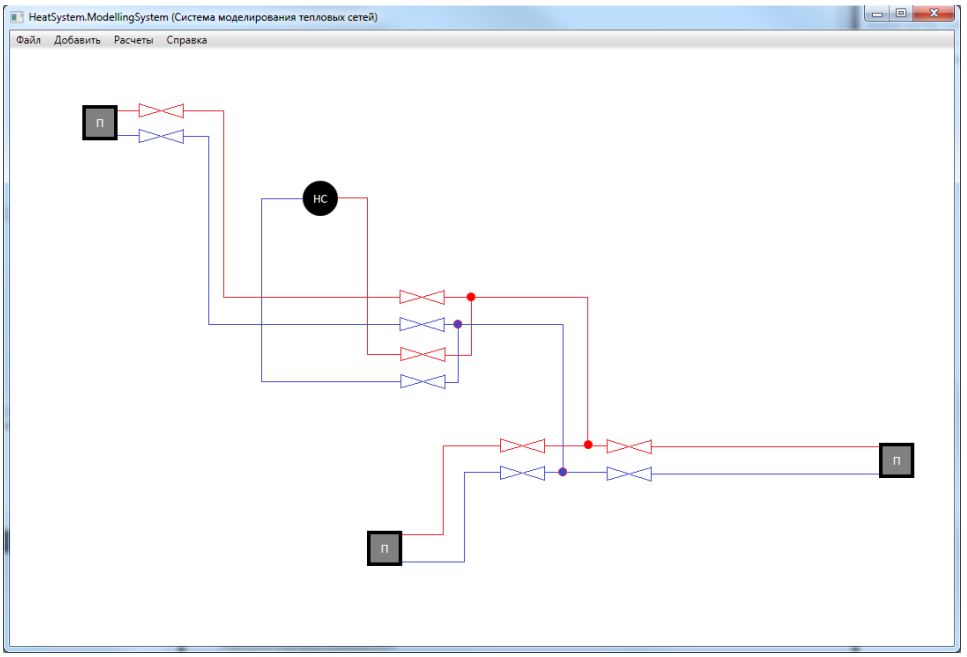

Figure 1. The user interface representation

The second module is math oriented and based on MATLAB libraries. It creates an algebraic set of equations, based on a heat system topology matrix. Once the parameter values are found, the specified system sections must be searched for these parameter values. The set of equations for liquid flow is based on Bernoulli equations. To solve a set of equations the numeric computing methods of the MATLAB package is used (particularly the following libraries libeng.dll, libmx.dll, libmat.dll). When the results are found, the appropriate parameter values are updated in the heat system topology matrix and the matrix is ready to transfer to any other software package component.

The third module is oriented for decision-making support. Its implementation is based on neural network technologies. It closely interacts with the math module, varying heat system input parameters, and analyzing parameters that change on other specified system sections. The main goal of this module is to perform the optimal heat system input parameters search and parameter changes forecast.

This software package developing approach and our close collaboration with the «Mogilev Heating Systems» organization made it possible for us to build a software package to automatize the optimal objective solution search process.