Methods of hierarchical optimization of hydraulic modes of heat supply systems

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The report focuses on problem arising at the stage of planning of hydraulic modes (GM) heat supply systems (HSS). In practice, this problem is solved by multivariate calculations of flow distribution [1]. The choice of ways to organize the modes entirely rests with the engineer. Automation of these tasks is hampered by a number of complexity factors, such as: large dimension; nonlinearity; discrete part of the variables; multicriteriality etc. For these reasons, at the moment there are no suitable for practical application techniques and software packages for optimizing HSS modes.

The report outlines a new, hierarchical approach to optimizing HSS modes, which allows solving the challenge of the dimensionality of the problem and simplifying the challenge of its multicriteria. The method of hierarchical optimization is to perform the following steps: 1) decomposition of hydraulically coupled HSS to main (MHN) and distribution (DHN) heat networks; 2) search for permissible limits for changing the mode parameters at decomposition points that guarantee the existence of admissible DHN modes; 3) optimization of the MHN regime, taking into account these constraints according to the economic criterion; 4) optimization of DHN modes by technological criteria at the values of the boundary conditions at the input of the DHN, obtained in item 3.

The problems arising here are mathematically reduced to the following classes: 1) problems of non-linear mathematical programming;2) mixed (discrete-continuous) mathematical programming problems with integer variables;3) one- and two-criteria mixed conditional optimization problems with boolean variables;

The constructive methods for solving the above problems are proposed, based on a combination of methods of sequential optimization, method of nonlinear programming, method of internal points [2], dynamic programming [1], method of branches and boundaries [3].

References

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