METHOD NUMERICAL AND EXPERIMENTAL INVESTIGATION OF HEAT AND POWER SYSTEMS

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One way to reduce the error computational analysis and experimental research is the use of computational and experimental approach.

Settlement and experimental approach to modeling and forecasting study heat- mass transfer processes enables identification of the parameters of the mathematical model of the solution of inverse problems of the available data of the experiments.

The purpose of research - development of methods aimed at reducing heat loss on the basis of theoretical and experimental data.

Materials and methods of research. In the course of the calculated and experimental studies is calculated Tm and Te experimental temperatures in the same temporal and spatial locations. Parametric analysis allows you to find the most important characteristics in the model P (required parameters). In solving inverse problems are P by minimizing the deviation between the experimental and calculated Tae TM temperatures. According to updated model parameters (found solving the inverse problem) to obtain solutions that most closely matches the results of the experiments.

Solution of inverse problems is important to identify the parameters used in the study of models, as an important step to ensure the adequacy of these models (if there is any experimental information about the process under study).

The results of research. For assessment (identification) parameters in the general case of nonlinear mathematical models (including models of heat and mass transfer processes) selected iterative Gauss-Newton method.

To find the unknown parameters vector P uses an iterative procedure based on the method of Gauss-Newton

The values are calculated solving the direct problem of heat transfer under certain (given at l = 0) parameters in the previous iteration l in the same space-time

point from where the corresponding values measured. The system of linear algebraic equations is solved by the dimension of the least squares method:

The iterative process leads to the minimization of a quadratic quality criterion for solving the inverse problem.

In order to deal with the instability of the solution of inverse heat transfer problems are encouraged to use complex regularizing procedures sharing which allows to obtain stable solutions:

- Given the limited top and bottom of the desired solution (the required parameters) inverse problems;

- Iterative regularization - stop the iterative process;

- Classical regularization AN Tikhonov

In this case we are talking about the use of forms of selection of feasible solutions in the construction resistant to initial information approximate solutions of some problems.

The methodology of the computational experiment and identification of the model parameters as follows:

- To solve the direct problem. In use as an input parameter vector P of the desired parameters. As a result, we obtain the values of temperature;

- From the resulting temperature is a sample of the most characteristic points of the points of experimental studies. The result is a point that has already used as the experimental data ("accurate experimental data");

- Carry out the search for a solution OST from 1 to n of the model parameters according to the method of successive identification. At the same time as the initial approximation is chosen vector of the desired parameters, which is different from P;

- Modeling the experimental error. As a result, we obtain the values as "indignant experimental data";

- To search for the same parameters P, as in Sec. 3, but on the "perturbed experimental data."

Thus, computational and experimental approach - a way of analysis, optimization and prediction of heat and mass transfer processes under study based on computer (computational) model, the adequacy of which is provided by parametric or structural identification using experimental information about the test process and the solution of inverse problems. Parametric identification - the definition of the values of some model parameters that minimize the difference of the experimental and calculated values of temperature and structural identification - identification of unknown components of the model, which also leads to minimize the deviation between the calculated and experimental values of temperature.

Conclusions

Research processes heat- mass transfer processes based on modeling of theoretical and experimental methods of analysis provides the most accurate solutions and to indicate ways to reduce heat loss.