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ANALYSIS POWER SHORTAGE MINIMIZATION METHODS IN THE MODERN PROCESSING SOFTWARE FOR ADEQUACY ASSESSMENT OF ELECTRIC POWER SYSTEMS

The optimization methods that correctly determine the minimum of power shortage that occurs in various states of electric power systems EPS has a key role in adequacy assessment (AA) of (EPS). A review [1-3] of modern computational complexes for estimating AA showed that the general concept of mathematical models is unified and can be described in the framework of the flow distribution problem; however, each model is unique in its own way and requires an individual approach to optimization. The constant development of EPSs leads to the complication and enlargement of systems, which in turn affects models, respectively, solving the optimization problem of such models, becomes resource-dependent, time-consuming and non-trivial task. The development of modern processing software also does not stand still and allows applying various technologies (vectorization, parallel computing) to optimization methods, which significantly increases their computational efficiency. In this regard, the goal of this study is to analyze the applied optimization methods to solve the problem of power shortage minimization in the modern processing software for adequacy assessment.

We define and solve of few tasks to achieve this goal, which are including a review of modern calculation systems for assessing the adequacy of EPS, a review [3] of models for minimizing power shortages, as well as iterative [4] and heuristic optimization methods used in their software, their modernized implementation options using parallel technologies. Program tests and experiments were also conducted, and the problem statement with quadratic power losses in the relationships between reliability zones and balance constraints by equalities was used as a model. The following set of optimization methods we analyzed in this investigation: the steepest descent (without normalization, with step normalization), conjugate gradients (variant with Fletcher-Reeves coefficients) standard and with parallel calculations, standard evolution and parallel differential evolution method.

The article compares the convergence rate of the applied optimization methods: selects the optimal tuning parameters for the conjugate gradient method, and a differential evolution method. We evaluate the effectiveness of the applied parallel technologies to the optimization methods and its impact both on the results of the solution itself and the general tendency of the time and resources spent on the solution tasks.

References

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