Optimal Approximation of Non-linear Power Flow Problem*

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This paper addresses Optimal Approximation of Non-linear Power Flow Problem. To solve it, the "trust region approach" method is used, which implies a consequent consideration of convex optimisation problems. The obtained results are compared with results of well-known methods such as SDP Relaxation and SOC Relaxation. The rate of convergence of studied method for large dimensions problems with tens of thousands of nodes is investigated.The results of direct computations confirm a higher rate of convergence for the proposed method and a reduction in the computational resources, necessary for performing each iteration.

Ключевые слова: *ключевое слово, ключевое слово, еще ключевые слова.*

1 Introduction

In this article we explore the problem of optimisation of the workload in the energy network in order to reduce the cost of electricity production. This is a very important topic in the power industry. Energy flows are huge, so any results, leading to small improvements in the scale of the power grid, lead to a tremendous economic effect.

The problem is called Optimal Power Flow problem (OPF problem). In general case this optimisation problem with conditions, imposed by nonlinear Kirchhoff's equations and the needs of consumers, has a convex functional and non-convex restrictions. A large number of articles offer various solutions. Linear approximation method suggests linearising the power flow constraints. Local optimisation methods are about looking for a local optimum of the OPF problem. And global optimisation methods propose convexifying the constraints imposed by the Kirchhoff's laws.

In this paper, we solve the OFP problem using the "trust region approach" method, which implies a consequent consideration of convex optimisation problems. We study the convergence of the method and the rate of convergence in relation to large dimension problems with tens of thousands of nodes.

The obtained results are compared with another methods: DC Approximation, LPAC Approximation, SDP Relaxation, SOC Relaxation, QC Relaxation. The results of direct computations confirm a higher rate of convergence for the proposed method and a reduction in the computational resources, necessary for performing each iteration.

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