# Conic optimization of electric power systems

Nowadays, the increasing energy crisis and environmental issues all over the world have become a hot topic of common concern [1].The regional integrated power-gas system [2], which can improve the energy utilization efficiency, reduce the emissions of greenhouse gas and connect the cooperation of traditional and sustainable energy sources [3], has obtained ...

In this paper, a mixed-integer second order conic programming (MISOCP) model was formulated to solve the reconfiguration problem of electrical distribution systems considering the simultaneous minimization of the total active power losses and the improvement of the reliability indices, SAIDI, SAIFI and ENS.

power systems are growing in complexity. This is in large part due to the high penetration of renewable energy sources and the advent of electric vehicles. The aim of this paper is to review the latest literature in order to demonstrate the success of conic optimization when applied to power systems. The main focus

This paper develops an optimization model for determining the placement of switches, tie lines, and underground cables in order to enhance the reliability of an electric power distribution system.

AC Optimal Power Flow: a Conic Programming relaxation and an iterative MILP scheme for Global Optimization ... Mertcan Yetkin; Kaarthik Sundar; Russell Bent Proving global optimality of ACOPF solutions, Electric Power Systems Research, Volume 189 ... Jean-Bernard Lasserre Global optimization with polynomials and the problem of moments, SIAM J ...

Optimal power flow (OPF) is the fundamental mathematical model to optimize power system operations. Based on conic relaxation, Taylor series expansion and McCormick envelope, we propose three convex OPF models to improve the performance of the second-order cone alternating current OPF (SOC-ACOPF) model. The underlying idea of the proposed SOC ...

To overcome the high computational cost of solving large-scale conic optimization problems, some studies propose more efficient variants such as second-order cone programming (SOCP) [95, 129] and quadratic programming (QP) [41, 138].

This paper presents in-depth comparative analyses of nonlinear nonconvex programming (NLNCP) and second-order conic programming (SOCP) models to solve the optimal power flow problem in electric power systems. For comparative purposes, two objective functions are considered (1) minimization of the active power generation costs and (2) minimization of ...

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The electric power grid is recognized as an essential modern infrastructure that poses numerous canonical design and operational problems. Perhaps most critically, the inherently large scale of the power grid and similar systems necessitates fast algo-rithms.

Distribution systems play an important role, delivering the electric power of generation system to individual consumers. Distribution system reconfiguration (DSR) is a large-scale combinatorial ...

The aim of this paper is to review the latest literature in order to demonstrate the success of conic optimization when applied to power systems. The main focus is on how linear programming, second-order conic programming, and semidefinite programming can be used to address a central problem named the optimal power flow problem.

This paper provides a tutorial overview of robust optimization in power systems, including robust optimization and adaptive robust optimization. We also introduce distributionally robust optimization. For illustration purposes, we describe and analyze a short-term operation problem and a long-term planning one. The operation problem allows identifying the ...

Diesel-generator, PV and BESS are selected for supplying electric power, while an electric chiller (EC) supplies the thermal energy demand. The objective function adds up to ($10.3) million. Although the operational commitment is considered during 8760 hly periods, only the first four days are displayed in Fig. 4. Despite the relative high ...

Zhang, C. Josz, and S. Sojoudi, "Conic Optimization for Control, Energy systems, and Machine Learning: Applications and Algorithms," ... [51] "Electric Power Systems and Equipment - V ...

that are limited by an upstream power limit. For electric vehicle chargers with an individual upstream power limit, constant power-constant voltage (CP-CV) charging can be used [7]1. In this case, the electric vehicle is charged according to the upstream power limit, until the maximum voltage limit is reached.

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formulate a new type of NP-hard graph cut arising from undirected multicommodity flow networks. ... Conic optimization of electric power systems: en_US: dc.type: Thesis: en_US: dc scription gree: Ph.D. en_US: dc ntributor ...

While this particular algorithm is well-suited for linear pro-gramming, it does not generalize to other conic programs such as semidefinite programming. Interior-point methods for linear programming, however, can be applied in the more general setting [16, 158].

A conic optimization problem minimizes a convex function over the intersection of an affine subspace and a convex cone. Two particular types of convex cones are relevant in power systems operation: the cone generated by semidefinite matrices and ...

Power systems are complex and dynamic and they employ advanced mathematical techniques for planning, operation, control, and analysis. One of the biggest challenges of power systems is that the physical experimentation and observation is not practical and thus planning and operation decisions rely on accurate replication of experiments using mathematical ...

This paper shows that the load flow problem of a radial distribution system can be modeled as a convex optimization problem, particularly a conic program. The implications of the conic programming formulation are threefold. First, the solution of the distribution load flow problem can be obtained in polynomial time using interior-point methods. Second, numerical ill ...

The state estimation problem for power systems belongs to the above model due to the quadratic laws of physics (i.e., the quadratic relationship between voltage and power), where each matrix A i has rank 1 or 2. Robust regression in power systems is referred to as bad data detection. This problem was rst

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Robust optimization (RO) has been increasingly applied to address electric power system problems in the past decade. Applications range from real-time operation and day-ahead unit commitment to maintenance and long-term transmission and generation expansion planning. As the electric power system undergoes funda-

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This has inspired many researchers to study the benefits of conic optimization for power optimization

problems. ... This framework is natural for optimization problems with oscillatory phenomena, which are omnipresent in physical systems (e.g. electric power systems, imaging science, signal processing, automatic control, quantum mechanics). ...

Conic optimization has recently emerged as a powerful tool for designing tractable and guaranteed algo-rithms for power system operation. On the one hand, tractability is crucial due to the large size of modern electricity transmission grids. This is a result of the numerous interconnections that have been build over time.

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In fact, the optimal power flow problem is an instance of complex polynomial optimization. We demonstrate its applicability on power systems by reviewing several recent publications. Finally, we review the latest progress on algorithms for solving conic optimization, which has seen a lot of activity in recent years.

Electric power systems have experienced continuous growth in all the three major sectors of the power system namely, generation, transmission and distribution. Electricity cannot be stored economically, but there has to be continuous balance between demand and supply. The increase in load sizes and operational complexity such as generation allocation, non-utility ...

2.4. Second-order conic programming relaxation The primary limitation of SDP-based relaxations is the rapid growth of problem dimension, which makes the problem computationally prohibitive to solve for large-scale power systems.