Cyber security analysis of state estimators in electric power systems

Cyber Security Analysis of State Estimators in Electric Power Systems Andr´e Teixeira*, Saurabh Amin+, Henrik Sandberg*, Karl H. Johansson*, and Shankar S. Sastry+ Abstract--In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and ...

This work is focused on one of the features of the control center: the state estimator. After a preliminary analysis of the conventional state estimators with respect to cyber attacks constructed according to this adversary model, new ideas for improving the security of ...

In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and reliable ...

It is seen that a large measurementredundancy forces the attacker to use large magnitudes in the data manipulation pattern, but that the pattern still can be relatively sparse. In this paper, we study stealthy false-data attacksagainst state estimators in power networks. The focus ison applications in SCADA (Supervisory Control and DataAcquisition) systems where measurement data is ...

Cyber Security Analysis of State Estimators in Electric Power Systems H. Sandberg, G. Dán, A. Teixeira, K. C. Sou, O. Vukovic, K. H. Johansson ACCESS Linnaeus Center KTH Royal Institute of Technology, Stockholm, Sweden LCCC Workshop on Dynamics, Control and Pricing in Power Systems May 19th, 2011 TexPoint fonts used in EMF.

A survey of distributed optimization and control algorithms for electric power systems. DK Molzahn, F Dörfler, H Sandberg, SH Low, S Chakrabarti, R Baldick, ... IEEE Transactions on Smart Grid 8 (6), 2941-2962, 2017. 1264: ... Cyber security analysis of state estimators in electric power systems. A Teixeira, S Amin, H Sandberg, KH Johansson ...

The aim of this thesis is to propose novel state estimators that are both ac-curate under no cyber-attack, and at the same time able to detect attacks that are undetectable by the conventional ...

Cyber-Security Analysis of State Estimators in Electric Power Systems Andr e Teixeira1, Saurabh Amin2, Henrik Sandberg1, Karl H. Johansson1, ... Teixeira et al. Cyber-Security Analysis of State Estimators in Power Systems. Outline 1 Introduction Motivation Problem Formulation 2 Background 3 Stealthy Deception Attacks

Outline. On state estimation, bad-data detection, and cyber stealth attacks in power systems. A security index. Definition and experimental validation. Computation. Protection and mitigation ...

Cyber security analysis of state estimators in electric power systems

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This paper is focused on the cyber security of linear state estimators (Kalman fil- ters) which are widely used in ATC systems for aircraft surveillance and control.

Today, power systems have transformed considerably and taken a new shape of geographically distributed systems from the locally centralized systems thereby leading to a new infrastructure in the framework of networked control cyber-physical system (CPS). Among the different important operations to be performed for smooth generation, transmission, and ...

The electrical power network is a critical infrastructure in today"s society, so its safe and reliable operation is of major concern. State estimators are commonly used in power networks, for ...

Cyber security analysis of state estimators in electric power systems. A Teixeira, S Amin, H Sandberg, KH Johansson, SS Sastry ... A cyber security study of a SCADA energy management system: Stealthy deception attacks on the state estimator ... Cyber risk analysis of combined data attacks against power system state estimation.

In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and reliable operation of these critical infrastructure systems is a major concern in our society. In current state estimation algorithms there are bad data detection (BDD) schemes to detect random outliers in the ...

Cyber-physical systems (CPSs) are integrations of computation, communication, control and physical processes. Typical examples where CPSs are deployed include smart grids, civil infrastructure, medical devices and manufacturing. Security is one of the most important issues that should be investigated in CPSs and hence has received much attention in recent ...

(DOI: 10.1109/CDC.2010.5717318) In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and reliable operation of these critical infrastructure systems is a major concern in our society. In current state estimation algorithms there are bad data detection (BDD) ...

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In this paper we analyze the cyber security of state estimators in supervisory control and data acquisition (SCADA) systems for energy management systems (EMS) operating the power network. Current EMS state estimation algorithms have bad data detection (BDD) schemes to detect outliers in the measurement data, based on high measurement redundancy.

In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and reliable operation of these critical infrastructure systems is a major concern in our society.

Abstract. In Chapter 1, general information was introduced to understand the PSSE process and to highlight its importance for the implementation of functions related to the monitoring and analysis of EPS security, that is, to carry out the real-time operation of EPSs.To enable a better understanding of this process, this chapter will present, in more detail, definitions, concepts, ...

This article is centered on the cybersecurity research of dynamic state estimation for power systems with measurement delays. Relying on mixed measurements from phasor measurement units (PMUs) and remote terminal units (RTUs), a delayed measurement model is constructed. A modified state estimator based on the Kalman filter (KF) is designed, which can ...

Cyber-physical power systems are getting more and more attention, ... Modeling is an important task for the analysis of power systems. For large power systems, modeling tasks involve upper dimensional matrices. ... Cyber security analysis of state estimators in electric power systems. Proceedings of the 49th IEEE Conference on Decision and ...

In this paper, we analyze the cyber security of state estimators in Supervisory Control and Data Acquisition (SCADA) systems operating in power grids. Safe and reliable operation of these critical ...

Developing and implementing metrics to assess the cyber security of practical power systems is necessary. Such metrics could be developed considering not only the impacts on the security of the operation but also the economic impacts on power markets.

Improving the cyber security of the state estimation combines multilayer defense systems. Novel robust signal processing and data-analytic methods could be very effective especially with the presence of synchrophasor measurements. Assessing the cyber security of the grid by evaluating the impact of undetected attacks is crucial.

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Cyber-Physical System Security Systems in which cyber & physical systems are tightly integrated Power systems Process control networks ... (Potentially) more catastrophic security incidents... Targeting nuclear plants Power Control Network . 4

The focus of this chapter is on the cyber security issues that arise in the context of state estimation (SE) in power systems. Real-time operation of the power systems uses the SE results, which consists of the evaluation of voltage magnitudes and phase angles at chosen buses or substations [8, 9].

This chapter discusses research directions to evaluate the cyber security and develop novel algorithms for securing today and tomorrow"s power state estimation and grid operation. State estimation is a critical application that provides situational awareness and permits efficient operation of the smart grid. The secure, accurate, and fast computation of the state estimates ...

This paper analyzes all possible attack cases to identify the estimator"s security hole in the worst case and recommends the most dangerous attack sequence among all stealthy cyber attacks for a class of linear estimators, namely, the a-v filter, which has wide applications. Cyber security has emerged as one of the most important issues in modern Air Traffic Control ...

Cyber security has emerged as one of the most important issues in unmanned aerial systems for which the functionality heavily relies on onboard automation and intervehicle communications. In this paper, potential cyber threats and vulnerabilities in the unmanned aerial system"s state estimator to stealthy cyber attacks are identified, which can avoid being ...