



The
University
Of
Sheffield.

Automatic
Control and
Systems
Engineering

The Department of Automatic Control & Systems Engineering
is pleased to announce the following seminar:

Information theoretic security in the smart grid

Dr Iñaki Esnaola

*Department of Automatic Control and Systems Engineering
The University of Sheffield*

Wednesday, 2nd April 2014 at 14:00
LT01, Sir Frederick Mappin Building

Abstract

The smart grid has recently been proposed as a new framework that addresses the challenges that power systems are facing. At its core lies the use of advanced sensing and communication networks that enable the operator to manage and control the grid in an efficient and reliable manner. However, the complex and dynamic nature of the power grid imposes significant difficulties in the acquisition of system state information. Additionally, while the deployment of a new communication infrastructure enhances the functionality of the grid, it also opens the door for new cybersecurity threats. In this talk, we study the theoretical limits of information acquisition in power systems. To that end, we use information theory tools to describe and quantify the interaction of information with the grid. First, we obtain information theoretic limits for the state estimation problem, where prior knowledge of the underlying stochastic process is usually limited. Specifically, we characterize the fundamental limits of Minimum Mean Square Error (MMSE) estimators using tools from estimation theory and random matrix theory. In the second part, we examine the confidentiality level that a network operator can attain from a physical layer security perspective. Remarkably, we provide closed form expressions of the asymptotic secrecy rate when an intruder compromises part of the sensing infrastructure. With the insight provided by the theoretical analysis, we expose the operational trade-offs between secrecy and grid design parameters. We conclude the talk with examples of practical attack scenarios simulated on IEEE test bus systems

Biography

Iñaki Esnaola received the MSc degree in Electrical Engineering from University of Navarra, Spain in 2006 and a Ph.D. in Electrical Engineering from University of Delaware, Newark, DE in 2011. He is currently a Lecturer in the Department of Automatic Control and Systems Engineering of The University of Sheffield, and a Visiting Research Collaborator in the Department of Electrical Engineering of Princeton University, Princeton, NJ. In 2010-2011 he was a Research Intern with Bell Laboratories, Alcatel- Lucent, Holmdel, NJ, and in 2011-2013 he was a Postdoctoral Research Associate at Princeton University, Princeton, NJ. His research interests include information theory and communication theory with an emphasis on the application to smart grid problems

*Refreshments will be available following the talk in Room D10, D Floor,
Amy Johnson Building*