Title: Modeling and Analysis Techniques for Smart Grids using Synchrophasor Measurements.

Abstract:

With the advent of smart grids, the increased installation of phasor measurement units (PMUs) at transmission networks, frequency disturbance recorders (FDRs) and micro-PMUs (µ-PMUs) at distribution grids, the measurement-based approach on power systems modelling has gained significant scientific interest.

Synchrophasor measurements can enable a wide range of applications. Among them, special interest is focused on the analysis of the dynamic performance and the stability of transmission and distribution networks. This is of utter importance due to the growing dynamic activity observed, especially in distribution networks by the operation of distributed generation (DG). For this purpose, system identification techniques are used as advanced mathematical tools to directly analyze the dynamic characteristics of power systems and develop models using recorded data sets. Several system identification techniques have been proposed in the literature, some of the most known are the Prony method, the matrix pencil, the eigenvalue realization algorithm (ERA), etc. Also, towards this direction, different measurement-based models have been proposed, as solutions to directly estimate the system model parameters from synchrophasor measurements.

In this lecture the measurement-based approach is presented in detail. First, the state-of-the-art smart grid applications taking advantage of synchrophasor measurements are described categorically and discussed in detail. Next, the presentation focuses on the dynamic analysis of smart grids using synchrophasor measurements. The fundamentals of mode estimation and of the most known identification techniques are presented. Next, the formulation of two measurement-based approaches for dynamic load and active distribution networks modelling are analyzed. The demonstrated case studies in each case highlight the benefits and advances introduced by the measurement-based approach for the efficient operation of smart grids.

Short Bio

Dr. Theofilos Papadopoulos was born in Thessaloniki in 1980. He graduated from the School of Electrical and Computer Engineering of the Aristotle University of Thessaloniki in 2003. He received the Ph.D. degree in 2008 and also held the postdoctoral position until 2014 at the same School. During 2010-2011 he was an Adjunct Lecturer in the Department of Automation in the Alexander Technological Institute of Thessaloniki, while during 2011-2014 he was an Adjunct Lecturer in the Department of Electrical Engineering of the Technological Institute of Western Macedonia. Also from 2011 to 2014 he worked as a consultant in the area of Renewable Energy Sources. He was also a visiting researcher in the University of Strathclyde, Glasgow, Scotland during 2012 and 2013.
He was appointed as a Lecturer in the Department of Electrical and Computer Engineering of the Democritus University of Thrace in September of 2014. Since 2017, he is an Assistant Professor at the same department. He has participated in 18 European and national Projects and he received the Basil Papadias Award for the best student paper, presented at the IEEE PowerTech 2007 Conference, Lausanne, Switzerland. He is SM of IEEE, MIET and member of the National Chamber of Greece.