COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

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for the degree of Doctor of Philosophy (Ph.D.)

Electric Power Distribution Systems: Optimal Forecasting of Supply-Demand Performance and Assessment of Technoeconomic Tariff Profile

March 12, 2019, 12:15 p.m.
Engineering East, Room 303C
777 Glades Road
Boca Raton, FL

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ABSTRACT OF DISSERTATION
Electric Power Distribution Systems: Optimal Forecasting of Supply-Demand Performance and Assessment of Technoeconomic Tariff Profile

This study is concerned with the analyses of modern electric power-grids designed to accommodate large supply-demand considerations in metro areas of large cities. Hence proposed are methods to determine optimal performance of the associated distribution networks *vis-á-vis* power availability from multiple resources (such as hydro-electric, thermal, wind-mill, solar-cell etc.) and varying load-demands posed by distinct set of consumers of domestic, industrial and commercial sectors. Hence, developing the analytics on optimal power-distribution across pertinent power-grids are verified with the models proposed. Forecast algorithms and computational outcomes on supply-demand performance are indicated and illustratively explained using real-world data sets.

This study on electric utility takes duly into considerations of both deterministic (technological factors) as well as stochastic variables associated with the available resource-capacity and demand-profile details. Thus, towards forecasting exercise as above, a Representative Load-Curve (RLC) is defined; and, it is optimally determined via an Artificial Neural Network (ANN) method using the data availed on supply-demand characteristics of a practical power-grid. This RLC is subsequently considered as an input parametric profile on tariff policies associated with electric power product-cost.

This research further focuses on developing an optimal/suboptimal electric-power distribution scheme across power-grids deployed between multiple resources and different sets of user demands. Again, the optimal/suboptimal decisions are enabled using ANN-based simulations performed on load-sharing details. The underlying supply-demand forecasting on distribution service profile is essential to support predictive designs on the amount of power required (or to be generated from single and/or multiple resources) versus distributable shares to different consumers demanding distinct loads.

Another topic addressed refers to a business model on a cost-reflective tariff levied in an electric power service in terms of the associated hedonic heuristics of customers versus service products offered by the utility operators. This model is based on hedonic considerations and technoeconomic heuristics of incumbent systems.

In the ANN-simulations as above, bootstrapping technique is adopted to generate pseudo-replicates of the available data set and they are used to train the ANN net towards convergence. A traditional, multilayer ANN architecture (implemented with feed-forward and backpropagation techniques) is designed and modified to support a fast convergence algorithm is used for forecasting and in load-sharing computations. Underlying simulations are carried out using case-study details on electric utility gathered from the literature.

In all, ANN-based prediction of a representative load-curve to assess power-consumption and tariff details in electrical power systems supporting a smart-grid, analysis of load-sharing and distribution of electric power on smart-grids using an ANN and evaluation of such electric power system infrastructure in terms of tariff-worthiness (deduced via hedonic heuristics), constitute the major thematic efforts addressed in this research study.

BIOGRAPHICAL SKETCH

Born in Barranquilla, Colombia.

B.S., 2002, Electrical Engineering, Universidad del Norte, Barranquilla, Colombia

Specialist, 2006, Engineering Project Management, Pontificia Universidad Javeriana, Bogota, Colombia

M.S., 2010, Electrical Engineering, Florida Atlantic University, Boca Raton, Florida

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CONCERNING PERIOD OF PREPARATION
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Time in Preparation: 2015 - 2019

Qualifying Examination Passed: Spring 2011

Published Papers:

D. De Groff, P. S. Neelakanta and R. Melendez: Electrical Power System Supporting a Smart Grid: ANN-Based Prediction of a Representative Load-Curve to Assess Power-Consumption and Tariff. American Journal of Energy and Power Engineering, 2018, vol.5(3),20-29. (ISSN: 2375-3897).

D. De Groff, P. S. Neelakanta and R. Melendez: Analysis of Load-Sharing and Distribution of Electric Power on Smart Grids: Application of an Artificial Neural Network Technique. International Journals of Computers and Technology. 2018, vol. 18. 7432-7439. (ISSN: 2277-3061).

P. S. Neelakanta, R. Melendez and D. De Groff, D., Evaluation of Electric Power System Supporting Smart-grid Infrastructure: Tariff-worthiness Deduced via Hedonic Heuristics (Being submitted to: EUROPEAN TRANSACTIONS ON ELECTRICAL POWER ENGINEERING).