Preface

Many engineering systems and science problems suffer from the issue of developing a system that can cope with variations of system or control parameters, measurements uncertainty, and complex multi-objective optimization criteria. The need for a priori knowledge and the inability to learn from past experience make the design of robust, adaptive, and stable systems a difficult task. Currently, research on energy resources is of great importance for future oil replacements, particularly in vehicles and other transportation. Computational intelligence has been proven to provide successful solution of complex optimization problems by fuzzy logic, neural networks, evolutionary algorithms, and genetic algorithms. They include system identification, parameter estimation, multi-objective optimization, robust solutions, adaptive systems, self-organization, and failure analysis.

This book aims to provide relevant theoretical frameworks and the latest empirical research findings in these areas. It is written for professionals who want to improve their understanding of the strategic role in the area of power, control, and optimization. Each book chapter is written by experts in their particular field of expertise.

Chapter 1 of this text describes coordinated intelligent operation and emergency control of electric power systems.

In Chapter 2 a Hopfield Lagrange network (HLN) is proposed for solving economic load dispatch (ELD) problem. HLN is a combination of Lagrangian function and continuous Hopfield neural network where the Lagrangian function is directly used as the energy function for the continuous Hopfield neural network.

The increased availability of reliable and efficient energy services that stimulates new development alternatives such as solar, wind, et cetera is discussed in Chapter 3. This chapter elaborates on the potential for such integrated systems in the stationary and portable power market in response to the critical need for a cleaner energy technology. Anticipated patterns of future energy use and consequent environmental impacts (acid precipitation, ozone depletion, and the greenhouse effect or global warming) are comprehensively discussed in this chapter.

Chapter 4 describes a dynamic smart Grid concept which enables electricity end-users to be acting on controlling, shifting, or curtailing own demand to avoid peak-demand conditions according to information received about electricity market conditions over the Internet.

The global warming and energy need requires developing emerging energy technologies for the electricity, heat, and transport markets are subject of discussion in Chapter 5. In this chapter are also discussed in great detail the emerging energy technologies that aim at increasing efficiency of energy utilization processes from energy sources and diminish CO₂ exhalation. The main aim of the chapter is to exhaustively present soft computing and computational intelligent techniques in the evaluation of emerging energy technologies.
Chapter 6 presents an overview of key issues and technical challenges in a regional electric network, following the integration of a considerable amount of wind power. A brief survey on wind power system, the present status of wind energy worldwide, common dynamic models, and control loops for wind turbines is given.

Modified Lagrangian bounds and a greedy heuristic are proposed and discussed in Chapter 7 for many-to-many assignment problems taking into account capacity limits for tasks and agents. A feasible solution recovered by the heuristic shown to speed up the subgradient technique to solve the modified Lagrangian dual. A numerical study is presented to compare the quality of the bounds and to demonstrate the efficiency of the overall approach.

Energy projects with extended life cycles and initial investments can be unprofitable under discount cash flow methods. Therefore, real options analysis has become relevant as a pricing technique for these types of projects, with private risks and high investment levels. Following this question, the work presented in Chapter 8 analyses different real options approaches to select the most acceptable for investing decisions in the energy sector.

Power loss reduction is considered as one of the main purposes for a distribution system’s designers and operators especially for recent non-governmental networks. Moreover, the nature of power loss challenges different methods to solve this problem, while various studies indicate effectiveness of reconfiguration and its high portion for this case. Thus, “reconfiguration” can be introduced as an optimization procedure to obtain economical high quality operation by changing the status of sectionalizing switches in these networks. Some major points, such as using different switch types, considering number of switching, and time varying loads which are almost neglected or not applied simultaneously in most pervious essays are discussed in Chapter 9.

In Chapter 10, the power system is considered as a continuum, and the propagated electromechanical waves initiated by faults and other random events are studied to provide a new scheme for stability investigation of a large dimensional system. For this purpose, the measured electrical indices (such as rotor angle and bus voltage) following a fault in different points among the network are used, and the behavior of the propagated waves through the lines, nodes, and buses is analyzed. The impact of weak transmission links on a progressive electromechanical wave using energy function concept is addressed.

In Chapter 11 analyses and monitoring of the power grid in Pakistan is presented.

Finally, in Chapter 12, a solution is proposed to a certain nonlinear programming difficulties related to the presence of uncertain technological coefficients represented by vague numbers. Only vague numbers with modified s-curve membership functions are considered. The proposed methodology consists of novel genetic algorithms and a hybrid genetic algorithm pattern search (Vasant, 2008) for nonlinear programming for solving problems that arise in industrial production planning in uncertain environments. Real life application examples in production planning and their numerical solutions are analyzed in detail. The new method suggested has produced good results in finding globally near-optimal solutions for the objective function under consideration.
The editors of this text want to thank all the contributors to this text for their time, energy and invaluable expertise that we believe will make this book a success and extremely valuable resource in the area of power management, control and optimization of engineering problems.

Pandian Vasant  
*Petronas University of Technology, Malaysia*

Nader Barsoum  
*Curtin University, Malaysia*

Jeffrey Webb  
*Swinburne University of Technology, Malaysia*