Chapter 6
FLC Technique in Smart Grid for Demand Side Management

Kitty Tripathi
Babu Banarsi Das Northern India Institute of Technology, India

Sarika Shrivastava
Ashoka Institute of Technology and Management, Varanasi, India

ABSTRACT

The chapter discusses the general characteristics of smart grid, which combines different state-of-the-art technologies intended for operative power distribution when the generation is decentralized. Fault's existence in the power grid is entirely unanticipated. Fuzzy logic is the computational intelligence technique that integrates the knowledge base of experts that is either human or system using the qualitative expression. This technique can successfully be applied for end-user who is a prosumer and aims for low electricity bill as well as provide intelligent decision-making skill in the agents of the multi-agent system. Fuzzy inference system can be efficiently used in such systems due to its capability to deal with imprecision, incomplete data, and its strong knowledge base.

INTRODUCTION

The power Sector is effectively using the conventional model of electric grid which was designed in the year 1896 based on the design theory of Nichol's Tesla, but due to the exhaustion of global energy source at a distressing rate, there is growing concerns over the intensifying greenhouse emissions which is produced due to the numerous conventional energy sources (U K Madawala, 2008).The established power system feed power from large central generating units through transformers to a high voltage interconnected network. Conventionally every generating unit is powered by thermal, hydropower, or nuclear power and the grid is used to transport the produced power to substantial, vast distances. This power is then passed through a number of distribution transformers and then delivered to the end-user. The distribution system prevailing feeds load and is the wide-ranging but almost passive network and

DOI: 10.4018/978-1-7998-2718-4.ch006

has minute communication and restricted control. There is no real-time monitoring of this load except huge industrial load so there exists little or no interaction amongst load and power system.

By means of its nature, power demand swings vastly; besides often, here exists circumstances when power demand turns out to be far more than what system can really deliver (M Brown, 2011). Every so often, managing an abrupt upsurge in demand turns out to be uncontrollable, and improper management of the demand produces failure. The system can also fail once an essential power line fails or else a big power plant trips down suddenly. The grid operator searches the problem then make efforts to correct it. This method is time-consuming and is dependent on the nature of the fault (Southern California Edision Smart Grid Strategy & Roadmap, 2011).

The Smart Grid is an effective solution for this increasing complexity prevailing nowadays in electric-grid processes. The Smart Grid is administrated by well-designed software systems that aid in making the grid more efficient in resource distribution, permits computerized decision-making, increase consistency, integration of renewable energy sources, then yield dynamic pricing amid the parties involved. The Smart Grid notion has stretched its action area from the industrial area towards home-electric consumers (J. Rventausta, 2010).

Energy Management Systems have turn out to be an authoritative aspect of smart grids (Bharat Menon Radhakrishnan, 2016), due to the massive challenges levied owing to real-time pricing, distributed generation along with the incorporation of erratic renewables. Owing to the uncertainty associated with renewable sources along with prominent fluctuations in the load demand, it is enormously significant to preserve the complete energy balance in such grids.

Relating the Renewable Energy Sources and Systems (RESSs) to utility power grids remains one of the most striving endeavors of Smart Grid (SG) development in many countries (Moaad Aboumalika, 2019). The challenge of assimilating RESSs remains that it is extremely inconstant, irregular as well as variable. Electric power grids should thus engross this inconsistency by means of a range of solutions.

Here are two general methods to the administration of any smart grid. Primarily, it is thinkable to stretch the utility to straight control over every DERs in the structure, that allows several types of optimization at the level of the complete grid. Furthermore, it is likely to give the prosumers that owns the DERs as an opportunity to exchange how individual DERs are used to accomplish grid-level purposes, created on economic encouragements, in this circumstance the prosumer is not certainly essential to disclose all related negotiating information with the utility (A. Masoum, 2014) (B.Qela, 2014).

BACKGROUND

From the global outlook, major factors behind smart grid are capacity, effectiveness, consistency, sustainability as well as the customer assignation. The greater capacity electricity grid is required in the utmost every developing country. Next to it, the electric vehicles will correspondingly claim a few changes on the grid within the developed countries. Electricity yield can be augmented by enhancing the effectiveness of the grid system. Next to it, the virtual capacity might also be increased by means of peak shredding practices (Zhuo, Gao, & Li, 2008).

Two key elements when seeing efficiency are losses in the system and how the resources are arranged/used. Losses frequently are subject to the load shape within the system; for example, moderately loaded trans-formers remain less effective, so it is anticipated that system functions at the adjacent capacity level. Consumption of system is a foremost factor once we are considering outlay in system resources.

Related Content

Symbiotic Organism Search Algorithm for Optimal Size and Siting of Distributed Generators in Distribution Systems
Tri Phuoc Nguyen, Vo Ngoc Dieuand Pandian Vasant (2017). *International Journal of Energy Optimization and Engineering (pp. 1-28).*
www.irma-international.org/article/symbiotic-organism-search-algorithm-for-optimal-size-and-siting-of-distributed-generators-in-distribution-systems/182806

The Politics of Climate Change and the Rising Demand for Global Energy in the 21st Century: Implications for Human and Economic Development
Ikedinachi Ayodele Power Wogu, Sharon Nanyongo Njie, Emmanuel Onyekachi Ezennwa, Charles Natahniel Chukwuedo, George U. Ukagba, Sanjay Misra, Emmanuel Uniamikogboand Esther Fadeke Olu-Owolabi (2021). *International Journal of Energy Optimization and Engineering (pp. 1-23).*
www.irma-international.org/article/the-politics-of-climate-change-and-the-rising-demand-for-global-energy-in-the-21st-century/280132

Comparative Energetic and Exergetic Analysis of Conventional and Sloped Solar Chimney Power Plants
Hela Atia, Adrian Ilinca, Ali Snoussi, Rachid Boukchinaand Ammar Ben Brahim (2020). *International Journal of Energy Optimization and Engineering (pp. 57-73).*
www.irma-international.org/article/comparative-energetic-and-exergetic-analysis-of-conventional-and-sloped-solar-chimney-power-plants/259977

Conclusions and Scope for Further Work
(2023). *Studies on Single and Double Actuator Based DC Attraction Type Levitation Systems: Optimization Techniques (pp. 190-194).*
www.irma-international.org/chapter/conclusions-and-scope-for-further-work/327150

DC/AC Conversion
(2010). *Technologies for Electrical Power Conversion, Efficiency, and Distribution: Methods and Processes (pp. 167-207).*
www.irma-international.org/chapter/conversion/39372