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Implementation of Double Loop Controller Tuned Super Lift Luo Converter and Unipolar Inverter for Solar Fed Grid Application

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Abstract- The main objective of this article is to generate Photovoltaic (PV) power generation with high power quality before it is connected to the grid. The PV side DC/DC conversion is done by Positive Output Elementary Super Lift Luo converter (POESLLC) with high voltage conversion ratio for better performance. The grid side AC conversion is achieved by adding a double loop controller and it is used to ensure less voltage variation in grid voltage during for line and load variations. DC power received from the solar panel is stabilized in the POESLLC converter with double loop controller, which consists of a PI controller on the outer loop and hysteresis current controller inner loop. In the second stage, open-loop Pulse Width Modulation (PWM) based unipolar full-bridge inverter is used to meet the power quality issues. This modified system avoids the closed-loop controller for inverter on grid side and also omits the Maximum Power Point Tracking (MPPT) algorithm in DC/DC conversion. The proposed system has some advantages such as fewer components, less weight and avoids complexity in controllers which inject steady current to the utility grid. The effectiveness of the converters is verified through MATLAB Simulink platform.

Keywords Solar PV; Double loop controller; Hysteresis current controller; Single Phase Unipolar Inverter (SPUPI); Luo Converter.

1. Introduction

The electricity supplied by a PV power generation unit depends on the solar insolation and temperature. In tropical countries, the availability of solar power in abundance, hence the photovoltaic system can meet the emerging power demand. The initial expenditure, however, decreases the importance of the solar PV system even if there are virtually no operating costs and repair costs. PV panel cost alone approximately 57 % of the system total cost, the battery cost [1] is around 30 % and the inverter cost along with MPPT control is around 7 % [2]. Numerous researches are going in the PV technology to reduce cost efforts. The cost of PV is anticipated to drop significantly per watt by 2020. On the other hand, the cost of other components [3] (DC/DC converter and inverter components, storage devices, instrumentation, etc.) must be reduced to reduce the total cost of a PV system. At PV cell level, the instrumentation involved in MPPT can be minimized [4]. In this article, to increase efficiency without MPPT and minimize cost

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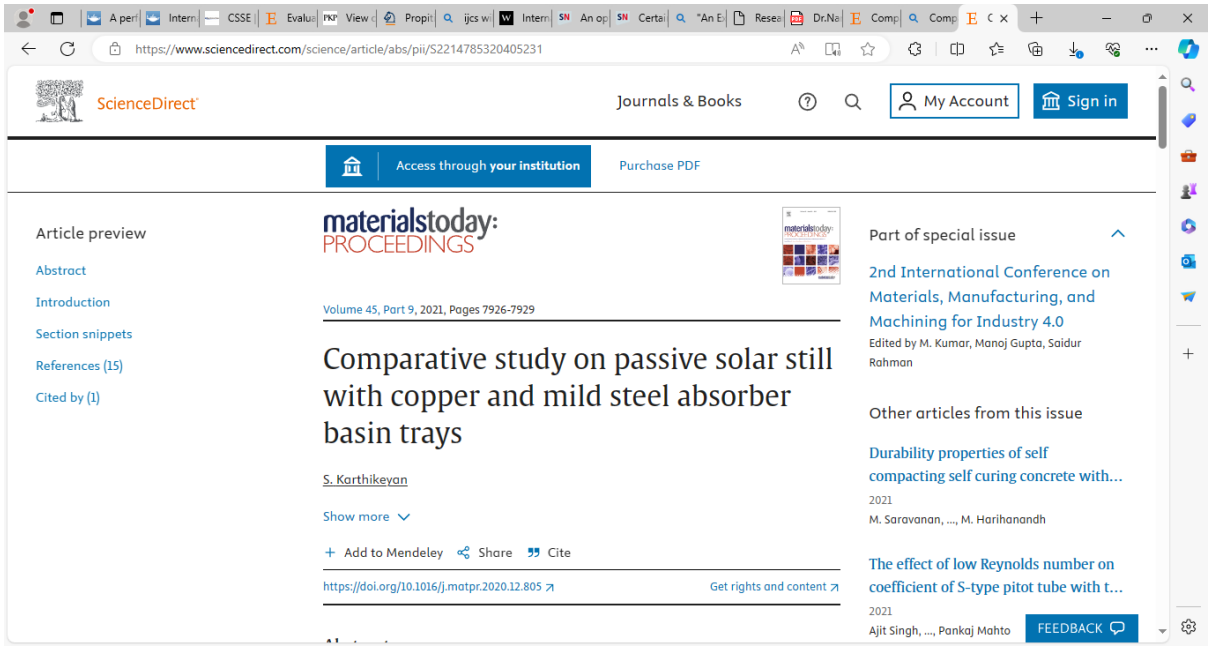
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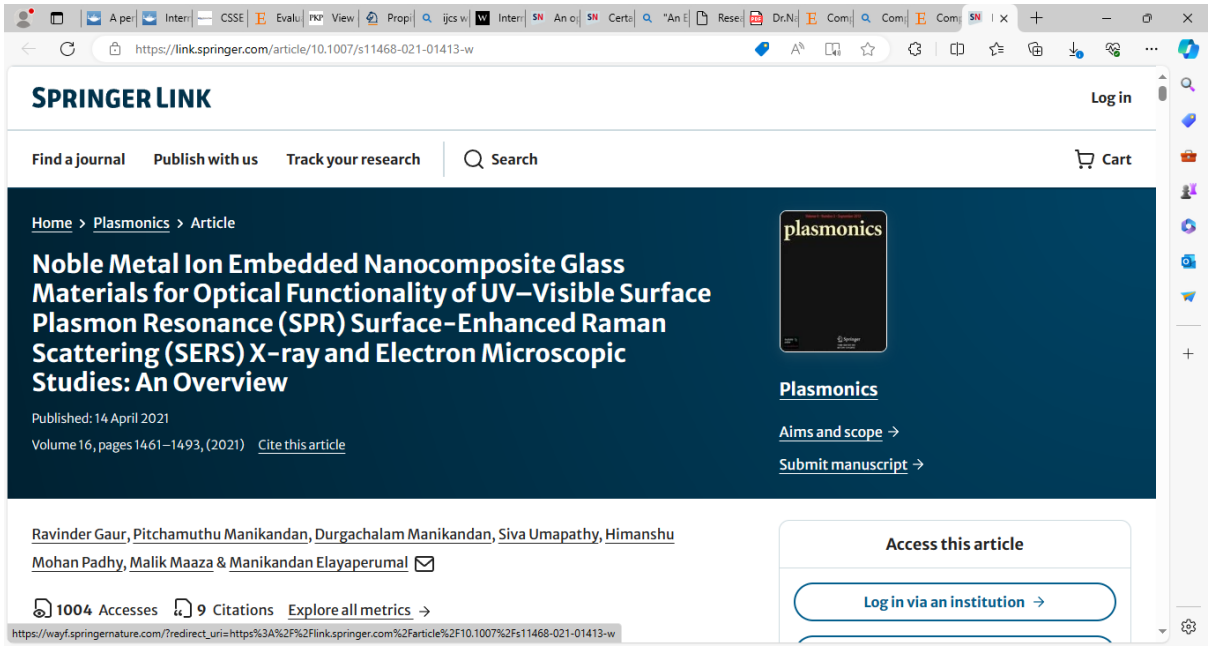
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Asymmetric Reduced Switch Fifteen-Level Multilevel Inverter for Unipolar PWM Scheme

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Abstract-
Multilevel *DC* to *AC* converters offers a higher capability of power allied with lesser output voltage harmonics and minor commutation losses. Their major weakness is their complication; need an enormous number of switching devices and passive device, and relatively difficult control circuitry. This paper focuses on the performed effort on one phase fifteen-level reduced switch *DC* to *AC* converter. Unipolar sinusoidal reference signal with triangular wave carriers is used in favour of producing the preferred switching pulses to produce the essential output *AC* voltage level. The asymmetric fifteen-level *DC* to *AC* converters circuit have been proposed and modelled through MATLAB-Simulink. The simulation outcomes are shows with fewer *THD* and bargain switching loss have been achieved.

Keywords*: Total harmonic distortion, DC to AC converters, Unipolar PWM, Reduced Switch, Multi-level Inverter.*

I. INTRODUCTION

The premises of multilevel inverter have been discussed more than 30 years back. The multilevel inverter has lots of rewards while compared to a predictable two-level inverter such as withstanding higher voltage facility, minor harmonic distortion, lesser switching losses, lesser switching strain, and producing the higher value of output voltage through superior electromagnetic compatibility [1]. The *MLI* technique not only creates superior voltage levels but additional also promotes renewable power creation strategy in input supply side [2]. *MLI* is one of the electrical energy exchange strategies that create *AC* kind voltage as output supply side using input supply *DC* source [3].

Minimum switching multilevel inverter module contain their individual reward and drawback. The module requires a bidirectional switching device in favour of achieving the preferred output *AC* voltage level. Utilization of bidirectional switching device increases, the whole count of switches in those modules, since the mixture of double unipolar switches makes single bidirectional switches through the impression of emitter attached to all switches [4-19]. A familiar topology of the inverters is full bridged 3-level. The 3-level inverter can satisfy qualifications through its extremely higher switching, although it might also regrettably enlarge switching stress and level of interfering to additional apparatus. Civilizing its *AC* output voltage waveform decreases its harmonic substance and, therefore, besides the dimension of the filter worn and the stage of *EMI* created through the inverter's switching process [20]. A variety of conventional topology of *MLIs* is worn in favour of exchange of *DC-AC* supply such *NPC MLI*, *FC MLI* and *CHB MLI* [21-22]. *NPC MLI* needs the additional number of diodes and the number of capacitors needs in the *FC MLI* is large for the reason that voltage harmonizing constraint.

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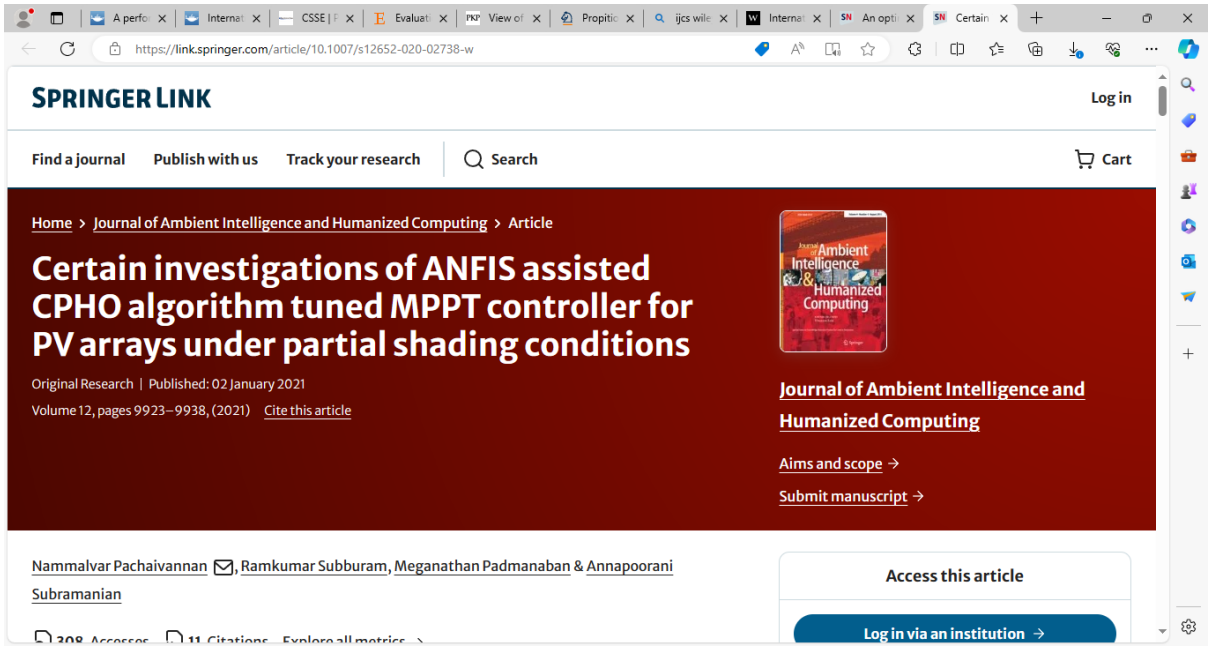
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An Extensive Study on Online, Offline and Hybrid MPPT Algorithms for Photovoltaic Systems

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ABSTRACT:
To moderate global warming, conventional fossil fuels are depleted. As the population increased with the rising standard of living and industrial growth, the global environment is affected and cause the greenhouse gases occurrence, which are frequently increased by unlimited use of fossil fuels. The generation of electric power loads increases the power demand on the basics of modern power technology development. Several benefits can be attained by installing the distribution generation with the quality and reliability of power delivered. However, the global energy problem can be resolved by renewable energy sources as an alternative energy generation. Technological developments in the last decade have increased the use of renewable energy sources. In worldwide, several renewable energy sources are used to attain their own power demand. The photovoltaic (PV) generation is the essential renewable energy source to serve the increasing electrical loads. The fastest-growing PV system has the naturally available energy sources of robust evolution with elegant benefits. The foremost objective of this paper is to examine the performance of the PV system with various Maximum Power Point Tracking (MPPT) algorithms. The solar irradiance and temperature make it complex to track the MPPT of PV systems. This review is about various MPPT algorithms like online, offline, and hybrid methods. The selected algorithms from each discussion are simulated in MATLAB/Simulink environment to match their performance in footings of the dynamic response and efficiency of the PV system under the variations of solar irradiance and temperature. An explanation and discussion of the PV system are achieved with the study of different types of MPPT algorithms of PV systems.

KEYWORDS: MPPT Algorithms, Solar Power, Renewable Energy, Hybrid System, PV System.

1. INTRODUCTION

As the continuous increase in the population in the worldwide atmosphere and the rigid greenhouse occurrence are pointedly frightening all the breathing creatures on earth, which is most threatened by the unrestricted use of fossil fuels [1]. The development of power electronics components increases power demand by the use of domestic loads, commercial loads and industrial loads. An alternative energy source is essential as a precise solution to overcome this energy problem by renewable energy sources. As a concern to this, a survey on renewable energy sources has been raised. The International Renewable Energy Agency (IRENA) in 2019 released the statistics of its renewable capacity reported as 171 GW is added in the world as an overall renewable energy capacity in 2018. Asia alone is accounted for 61% of the total renewable energy installation in 2018 with a growth rate of 11.4%.

As of 2018, on the basis of global power generation capacities installed, five renewable energy sources are listed by the power technology. Hydropower installed capacity of 1295 GW, is higher than 18% of the total power generation capacity installed worldwide and

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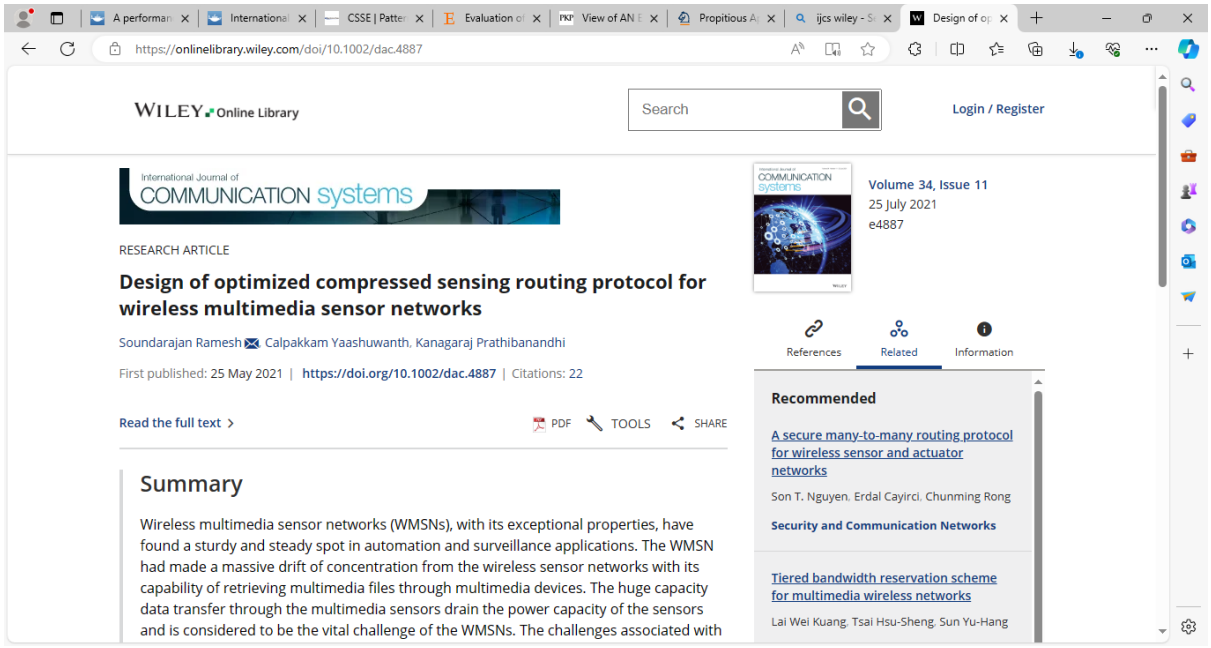
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RESEARCH ARTICLE
Design of optimized compressed sensing routing protocol for wireless multimedia sensor networks
Soundarajan Ramesh, Calpakkam Yaashuwanth, Kanagaraj Prathibanandhi
First published: 25 May 2021 | https://doi.org/10.1002/dac.4887 | Citations: 22
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A secure many-to-many routing protocol for wireless sensor and actuator networks
Son T. Nguyen, Erdal Cayirci, Chunming Rong
Security and Communication Networks
Tiered bandwidth reservation scheme for multimedia wireless networks
Lai Wei Kuang, Tsai Hsu-Sheng, Sun Yu-Hang
Summary
Wireless multimedia sensor networks (WMSNs), with its exceptional properties, have found a sturdy and steady spot in automation and surveillance applications. The WMSN had made a massive drift of concentration from the wireless sensor networks with its capability of retrieving multimedia files through multimedia devices. The huge capacity data transfer through the multimedia sensors drain the power capacity of the sensors and is considered to be the vital challenge of the WMSNs. The challenges associated with

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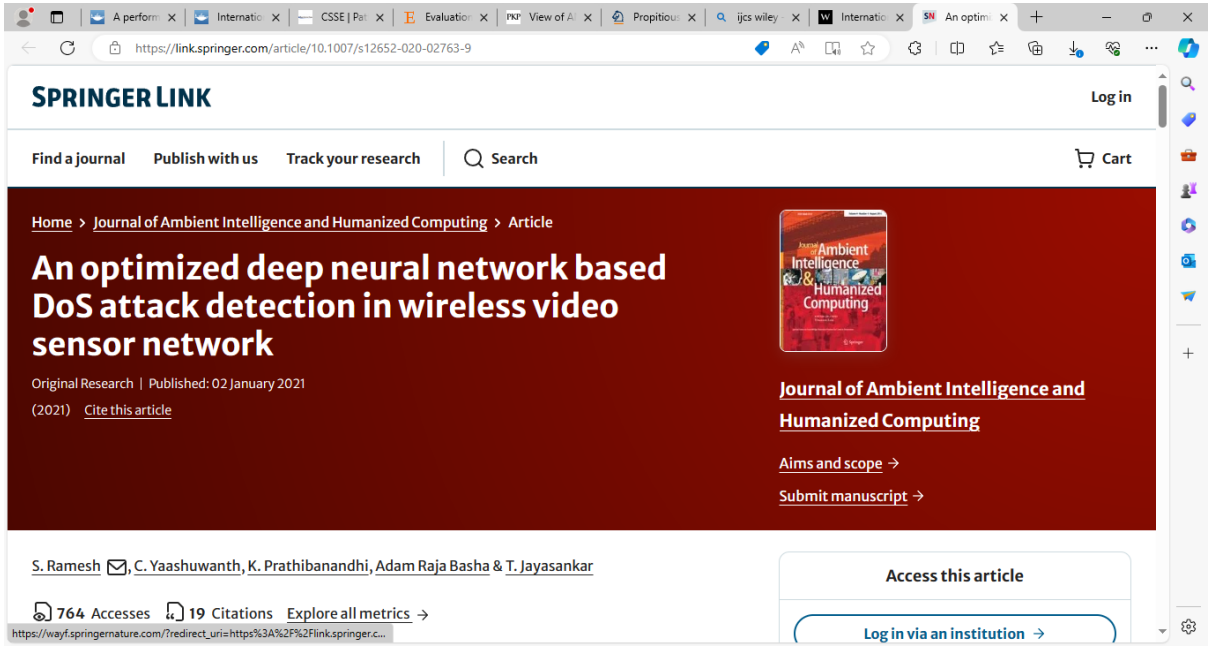
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Optimal Generation Scheduling Considering Renewable Energy Sources

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Abstract- This paper presents a competent approach to solve the unit commitment problem with consideration of wind and solar energy systems. The integration of wind and solar energy in the existing power system is considered to reduce the thermal unit operating cost. Abundant literatures have been reported for the thermal Unit Commitment (UC) solution. The Renewable Energy Source Integrated UC (RESIUC) problem is more complex in nature that requires a competent optimization tool. Hence, the novel swarm intelligence technique known as Grey Wolf Optimization (GWO) algorithm has been applied to determine optimal solution for the intended UC problem. The potential of the GWO algorithm has validated using standard 10-unit system. Numerical results show a considerable improvement in the quality of the solution obtained.

Keywords – Generation Scheduling, Grey Wolf Optimization, Renewable Energy, Unit Commitment

I. INTRODUCTION

The objective of the Unit commitment (UC) problem is to determine optimum schedule of all the units. The committed units must meet the system demand and reserve requirements at minimum operating cost, subject to a variety of constraints. UC is a vital optimization problem for daily economic operation and planning of modern power systems. Since UC problem involves many variables and constraints, it is complicated to determine the optimum start-up and shut down schedules of generating units. The augment of ecological shield and the progressive exhaustion of conventional power plants have increased the interest in incorporating Renewable Energy Sources (RES) into existing power system.

The UC is a non-convex, large-scale mixed integer nonlinear programming problem. It is difficult to determine the best feasible scheduling for UC problem within reasonable computational time and memory requirement. Abundant methods have been evolved to solve the UC problems. They can be categorized into traditional, soft computing and hybrid techniques.

The deterministic methods for thermal UC include Integer Programming (IP) [1], Branch-and-Bound (BB) [2], Priority List (PL) [3], Dynamic Programming (DP) [4], Mixed Integer Programming (MIP) [5] and Lagrangian Relaxation (LR) [6] methods. Most of the above approaches face the problem of dimensionality, particularly in case of large-scale systems. The soft computing techniques are used to address the demerits of mathematical approaches. Soft computing techniques such as Genetic Algorithm (GA) [7], Simulated Annealing (SA) [8], Neural Network (NN) [9], Differential Evolution (DE) [10], Ant Colony System (ACS) algorithm [11], Bacterial Foraging Algorithm (BFA) [12], Shuffled Frog Leaping Algorithm (SFLA) [13], Particle Swarm Optimization (PSO) [14], Quasi-Oppositional Teaching Learning Based Optimization (QOTLBO) algorithm [15] and Invasive Weed Optimization (IWO) [16] and Fireworks Algorithm [17] have been reported in the field of thermal UC.

Hybrid methods include Hybrid Taguchi (HT) - ACS [18], LR and PSO [19], hybrid harmony search/random search algorithm [20] and LR-DE [21] have been reported to solve thermal UC problems.

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Unit Commitment Solution for a Wind-Thermal Power System

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Abstract- The Unit Commitment (UC) problem is treated as most complex optimization problems in power system operation, since it involves several variables and constraints. The integration of wind power with existing power system increases the complexity of power system operations due to its inadequate predictability, variability and intermittent nature. The penetration of wind power reduces the usage of fossil fuel in the traditional generating plants significantly. It not only makes saving of money, also it reduces the pollutant emission from the fossil fuel plants. This paper employs a novel metaheuristic algorithm known as Grey Wolf Optimization (GWO) for solving the UC with Wind Power Penetration (UCWPP) problem. The proposed algorithm has been applied to 4 and 12 generating units, considering 24 hours scheduling period. Furthermore, the ramp rate limits are also included in the mathematical UCWPP formulation. The simulation results reveal that GWO method has higher potential for solving UCWPP problems.

Keywords – Grey Wolf Optimization, Power System Operation. Unit Commitment, Wind Power.

I. INTRODUCTION

The Unit Commitment (UC) problem is to determine the optimal on /off status and the generation of each unit. The purpose of unit commitment is to minimize the total generation cost while the load demand reserve requirement and unit constraints are satisfied. The unit commitment is a classical non convex mixed integer problem and remains a key process for optimizing power systems scheduling. UC is the optimization problem used to determine the operation schedule of generating units at each hour with varying loads and generating under different generation, environmental and technical constraint. Renewable generators attracted prominence in power sectors to reduce emission of green house gas and power generation costs. As a result the equilibrium between supply and demand side and the reliability of the power system is hard to manage.
The penetration of wind energy is increased significantly in past two decades and is expected to continue rising in the future. The existing power system operation has significantly challenged by wind power penetration. The merit of wind power is sustainable and has zero carbon emissions. On the other hand, it is intermittent and highly complicated to forecast. Here, the wind power is integrated with thermal generating units, thus UC with Wind Power Penetration (UCWPP) problem has formulated. Profuse techniques have been developed and applied to solve the UC problems. They can be classified into deterministic, artificial intelligence and hybrid methods.

The unit commitment problem has been solved by different optimization techniques like Mixed Integer Programming (MIP) [1], Stochastic Dual Dynamic Integer Programming (SDDIP) [2], Mixed Integer Linear Programming (MILP) [3], Benders Decomposition (BD) [4], Unit Decommitment (UD) method [5], Harmony Search (HS) Algorithm [6], Enhanced Simulated Annealing (ESA) approach [7], Artificial Neural Network (ANN) [8], Neural Based Tabu Search (NBTS) method [9], Hybrid Artificial Neural Network-Dynamic Programming (HANN-DP) [10] approach, Genetic Algorithm (GA) [11], Cooperative Coevolutionary Algorithm (CCA) [12], Annealing-Genetics (AG) algorithm [13], Hybrid Particle Swarm Optimization (HPSO) [14], Improved Simulated Annealing Particle Swarm Optimization (ISAPSO) [15], Improved Dragonfly Algorithm (IDA) and Particle Swarm Optimization (PSO) [16], Augmented Lagrange Hopfield Network based Lagrangian Relaxation (ALHN-LR) [17].

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Research Article

12

Experimental Investigation on the Ecofriendly External Wrapping of Glass Fiber Reinforced Polymer in Concrete Columns

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An ecofriendly fiber reinforced polymer (FRP) had been used in the last decade to enhance the short concrete column's strength and deformation capacity. This study involves the wrapping of FRP sheets with a thickness of 3 mm and 5 mm on a short column, and then the compressive strength is determined. The rectangular columns of size 150 mm × 300 mm are used for this study, and cast under the grades of M20 and M40 are wrapped with GFRP sheets at the thickness of 3 mm and 5 mm. These results are clarified at a specific thickness of the FRP-wrapped columns. It provides a maximum axial compressive strength, and Young's modulus gets enhanced rigorously when it is to be compared to the normal concrete. This thesis deals with experimental studies of different parameters associated with wrapped glass fiber reinforced polymer (GFRP). In M20 grade, when the 3 mm wrapped specimen and the 5 mm wrapped specimen are compared, the specimen wrapped with 5 mm increases 5.182% more than the specimen wrapped with 3 mm. In M40 grade, when the 0 mm, 3 mm, and 5 mm wrapped specimens are compared, the specimen wrapped with 5 mm increases 2.47% more than the specimen wrapped with 0 mm. The 5 mm wrapping attains the maximum strength.

1. Introduction

Fiber reinforced polymer (FRP) is a composite material made up of a matrix reinforced with polymers. A vast amount of experimental work was conducted on FRP columns in the last decade. Natural disasters such as hurricanes, tornadoes, tsunamis, earthquakes, and unintended effects can destroy or damage the secondary structures in a matter of seconds. On the other hand, the salt water, chemical, and freeze-thaw cycles can induce structural degradation for a longer time [1]. Many old buildings and bridges were designed according to the old construction codes. FRP materials are a new technique that has gained popularity in recent years. As a result, these kinds of materials have been used for decades in other industries such as shipbuilding and defense, which provide novel solutions for rehabilitating decaying civil infrastructure. The continual deterioration of infrastructure has heightened awareness of the need for effective structure rehabilitation procedures. A peculiar challenging problem confronting engineers in the revival of the infrastructure is the rehabilitation of concrete structures. The use of externally bound FRP sheets and strips was