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ENHANCEMENT OF LVRT CAPABILTY OF GRID TEID WECS

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Abstract: Determining the voltage collapse point using an efficient approach greatly aids in the design and operation of power systems. There are several methods to calculate the power flow, but they do not provide the optimal operating condition, i.e. the maximum load point of a system without exceeding the power limits of the generators. Particle Swarm Optimization (PSO), which directly determines the voltage dip point without sequential current flow calculations and also provides the optimal operating state. The proposed approach has been tested with a 6-bar test system and evaluated for various stress stability analysis applications, taking into account the role of static variables. Compensators. Additionally, the performance of the proposed approach is evaluated using the Continuation Power Flow method.

1. INTRODUCTION

Wind Energy Conversion System

Wind electricity is the quickest developing renewable electricity source. With the latest technological improvements in electricity electronics, thinking about wind Electricity as an essential a part of electric electricity era is vital. However wind is an uncontrollable useful resource and this selection makes it a tough mission to integrate massive wind farms right into a grid. Stability and electricity first-rate are the primary problems. Wind generators are taken into consideration as disbursed turbines (DGs) which are linked to the distribution a part of a electricity grid. Rather than conventional electric powered electricity sources which includes nuclear and hydro power flowers which are centralized and are the primary resets of electrical electricity turbines, DGs are decentralized and positioned in weaker elements of the electricity grid. With small potential wind farm linked to the electricity gadget , intermittent electricity glide of wind farm does now no longer pose a first-rate chance to the stableness of electricity gadget. As wind generators emerge as large and stage of penetration turns into higher, Voltage balance and electricity first-rate of the gadget have to be taken into account. One of the problems that may jeopardize uninterrupted operation of wind generators is grid disturbance. In the past, wind generators may be disconnected from the grid at some stage in grid fault; due to the fact their influences at the grid have been now no longer significant. As wind farm receives large and the penetration stage increases, the influences can't be omitted anymore . The disconnection of massive quantity of wind electricity turbines can have severe bad effect at the grid. The tripping of massive wind farm can reason lengthy restart delays and manufacturing losses. These facts dictated the need of a fixed of complete grid codes. Grid codes are sure policies which are formulated through Transmission System Operators (TSOs) which may be distinct from one area to another [3].

Low voltage ride through

LVRT is a part of the grid code which states that wind mills are required to remain related to the grid for a selected quantity of time in any other case they may be disconnected. This particular quantity of time may be one of a kind from one grid code to another; additionally the severity o the fault is probably one of a kind as well. Voltage instability in a energy gadget takes place because of loss of good enough reactive energy all through grid fault [7]

2. MOTIVATION AND OBJECTIVES

LVRT functionality of a wind farm has been the challenge of many researches in the course of recent years. An uninterrupted operation of wind farm for a sure time frame Is dictated via way of means of many Indian, European and North American grid codes. External reactive energy compensate inclusive of STATCOM is a powerful manner to ensure uninterrupted operation of DFIG wind turbine in the course of grid fault in a vulnerable grid. Employing a STATCOM isn't the maximum good value answer for LVRT development of wind turbine in a vulnerable grid; however it's far the simplest option to address this trouble as said in lots of literature. And get better lively energy UPFC is first-rate answer. UPFC, now no longer handiest get better the lively energy however additionally improves the voltage via way of means of offering required quantity of reactive energy to the machine as said in lots of literature So, with the aid of using employing UPFC with the constant velocity WECS we are able to decorate the LVRT functionality of the WECS as its offering All grid necessities beneath neath fault condition

The goals of this thesis include:
1. Analyzing the consequences of constant WECS with stat-com beneath neath fault condition
2. Analyzing the consequences of constant WECS with UPFC beneath neath fault condition
3. Comparing the consequences of each UPFC and STATCOM and giving touch

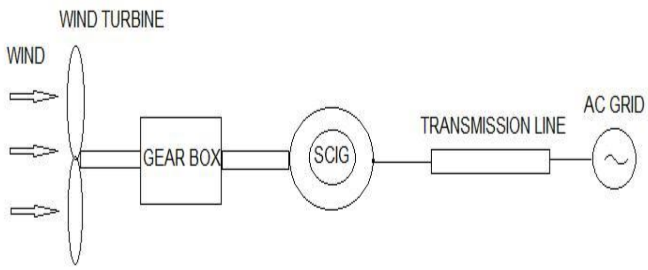
Upon the general performance.
4. Analyzing the consequences with the aid of using changing pi managed UPFC and STATCOM with the Fuzzy common sense controller

THESIS LAYOUT
This thesis includes 7 sections. The first chapter blanketed technical background,. Motivation and goals also are given on this bankruptcy. The relaxation of the thesis is prepared as follow: In chapter 2 literature evaluation associated with the proposed paintings became discussed. In chapter 3, wind turbine traits and aerodynamic modeling is explained. In chapter 4, STATCOM version and. Its exceptional mode of operation is discussed. In chapter 5, five UPFC versions and its exceptional mode of operation is discussed. In chapter 6 Fuzzy common sense controller for changing the traditional pi controllers of STATCOM and UPFC is discussed. In chapter 7, Results and evaluation of the constant WECS with STATCOM and UPFC had been discussed.

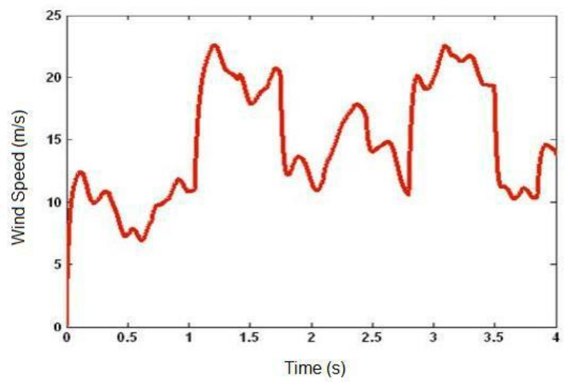
3. LITERATURE SURVEY.

Literature survey refers to the previous documentation related to the study cited by accredited scholars and researchers. Voltage control is one of the most important aspects in the interaction of wind turbine generation system (WTGS) to grid [1]. Coupling of WTGS to grid needs two main requirements: reactive power control during normal operating condition, and LVRT capability during fault condition. The LVRT requirement ensures that wind turbine generators must remain connected to the grid in fault condition. To achieve the optimum efficiency in conversion from wind kinetic energy to the electrical energy, modern variable speed wind turbines (VSWT) are capable of varying their speed by power electronic converters. With an adequate control, the converters can be used to provide voltage support at the level of grid interface [2], [3].
However, modern VSWT are not the only ones installed in wind farms. There are important amounts of fixed speed wind turbine (FSWT) still in use. The FSWT exhibits poor FRT performance during fault condition as the induction generator draws reactive power during fault. When a fault occurs, a voltage drop suddenly occurs at the terminal of IG. Therefore, the electrical torque abruptly deceases to zero due to the reduced terminal IG voltage and the rotor speed starts to increase. After fault clearance, the reactive power consumption increases resulting in a period of voltage reduction at the IG terminal. Thus, the induction generator voltage does not recover immediately after the fault and a transient period follows. Therefore, the generator continues to accelerate and becomes unstable [4]–[6]. Hence, providing the required reactive power not only improves voltage regulation; but also helps to damp the rotor speed oscillations Many papers have been discussed using of shunt FACTS controllers like SVC to improve the FRT of WECS [6]–[7].
In [8], Ahsanullah and Ravishankar described application of various dynamic controllers consisting of STATCOM and UPFC to enhance FRT in doubly-fed induction generators (DFIGs). Their study was mainly related to the effects of FACTS on the voltage variations at the point of common coupling (PCC) and FRT capability based on a fixed wind speed.

FIXED SPEED WIND ENERGY CONVERSION SYSTEM
The schematic diagram of a standard WECS is proven Fig 3.1.1... With the assist of wind turbine the kinetic electricity of wind is transformed into the mechanical electricity .With the assist of equipment container the generated Mechanical electricity receives boosted up and that is fed to the induction generator where, the mechanical electricity is transformed into electric electricity The generated electricity from the induction generator is fed to AC GRID via the transmission community directly.Since , the wind turbine is operated at consistent speed , the frequency and voltages are regular values as in step with the grid requirement



Schematic diagram of Fixed Speed WECS



Wind Speed Model

Wind turbine model
The constant velocity wind turbine consists of a immediately grid coupled squirrel cage induction generator related to the wind turbine rotor via a gearbox. The rotor limits the electricity extracted from the wind with the aid of using the use of the stall effect (stall regulated wind turbine) or with the aid of using controlling the blade pitch angle (pitch regulated wind turbine)to lower the rotor aerodynamic performance for high wind speeds and hence restricting the mechanical electricity extracted from the wind. For electricity structures simulations, the conduct of wind turbine may be represented with the aid of using modeling the rotor, power educate and technology gadget version with squirrel cage induction generator and compensating capacitors. In general, the relation among wind velocity and mechanical electricity extracted from the wind may be described, as follow [12]-[13]:

$$P_{wt} = \frac{\rho}{2} A_{wt} C_p(\lambda, \theta)$$

Where,

Pwt is the power extracted from the wind

ρ is the air density,

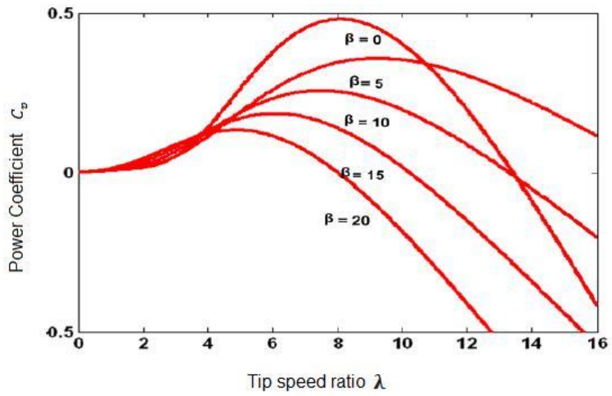
V is the wind speed,

Cp is the performance or power coefficient,

λ is the tip speed ratio,

Awt is the area covered by the wind turbine rot

$$C_p = \frac{1}{2}(\lambda - 0.022\beta^2 - 5.6)e^{-0.17\lambda}$$



4. CONCLUSION

PSO is a novel optimization technique that solves the disadvantages of classical methods mentioned above. This method also takes OOC into account. PSO determines VCP without various power flow calculations and also considers OOC since PSO accepts inputs randomly, so a situation may arise that it does not give a satisfactory result in the first test. But it is very sure that after a few tries we will get the right result.

5. FUTURE SCOPE

In the future, the power sector will be very large and the grids of the power grids will become more complicated, so the accurate voltage stability analysis (i.e. the determination of VCP) will be a big concern. In addition, we can consider the other versions of the PSO-based approach, such as Adaptive PSO (APSO), Passive Congregation-Based PSO (PC PSO), and Self-Organizing Hierarchical PSO (SOH PSO).

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