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MODIFIED VOLTAGE CONTROL STRATEGY FOR DC NETWORKS WITH DISTRIBUTED ENERGY STORAGE USING A FUZZY LOGIC CONTROLLER

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AbstractResearch, development, and deployment of efficient and cost-effective offshore wind interconnection options are critical to meet Europe's ambitious renewable energy ambitions. Voltage Source Converter (VSC) High Voltage Direct Current (HVDC) transmission is the current trend in offshore wind integration research and commercial applications.

This paper will present a momentous approach for distributed energy storage (DES) in DC distribution network,which is the flexible voltage control strategy for strengthening the voltage stability and reliability in DC network at various perturbations. Moreover, the parameter of the AC and DC networks will beanalyzed briefly under demonstrated virtual inertia and capacitances.Cascading droop control Technique with fuzzy is suggested. The simulation outcomes will render the fruitful response for improving the voltage stability in DC distributed network as compared to other existing techniques.

Keywords: Distributed energy storage, flexible voltage control strategy, fuzzy, voltage stability.

1.INTRODUCTION

The study, development, and implementation of cost-effective and efficient interconnection options.Offshore wind is a critical component in meeting Europe's ambitious renewable energy ambitions. Voltage Source Converter (VSC) High Voltage Direct Current (HVDC) transmission is the current direction in offshore wind integration research and commercial applications [1]. Compared to standard Line Commutated Converter (LCC) technology, VSC-HVDC offers substantial control and design advantages. With the growing use of renewable energy and microgrids, the traditional AC distribution network faces significant hurdles in terms of plug-and-play performance and operating stability, where DC solutions excel.As a result of the increasing demand for power system operation and the success of DC technology in some specific applications, such as large-scale data centres and shipboard systems [2]. Since there are no other parameters to consider, such as reactive power and phase synchronisation.Master-slave control and voltage droop control are the two most common types of voltage control methods used today. One voltage source converter (VSC) is designated as the slack terminal in a master-slave control method, which implies it is responsible for tracking DC voltage variations and maintaining the voltage at the reference value.

2.DC DISTRIBUTION NETWORK VOLTAGE CONTROL STRATEGY

The DC network can be classified into three kinds, similar to the AC distribution network: The radial structure, the ring structure, and the dual or multi-terminal structure are the three types of structures .The typical twin terminal DC network explored in this article is shown in Fig. 1. The isolation transformers and the voltage source converter (VSC), which have electric isolation capability and work together to scale down the voltage and transfer AC power into DC format, are connected to the 4 kV DC network at the terminal to achieve good fault ride-through capability. The following three components are connected to the network using DC wires.

2.1. AC/DC MICRO GRID

This type of element is made up of distributed generators (DGs), energy storage systems (ESs), and local loads, the power of which is changed on a regular basis in response to changes in natural environment elements like wind speed or photovoltaic irradiation. When power demand is low, the microgrid adjusts the amount of electricity absorbed from the DC network. The microgrid can be used to change the voltage of the distribution network on occasion.

2.2. Loads (AC/DC)

The aggregative loads have a one-way power flow and are therefore difficult to consider for voltage management. Except in rare emergency situations, loads can be shed passively to relieve network congestion.

2.3. Independent ES unit

This device can be deployed at any node and provides DC voltage supplementary or backup support. To adjust for voltage variations, the signal of node voltage is gathered as an input for the ES unit controller.

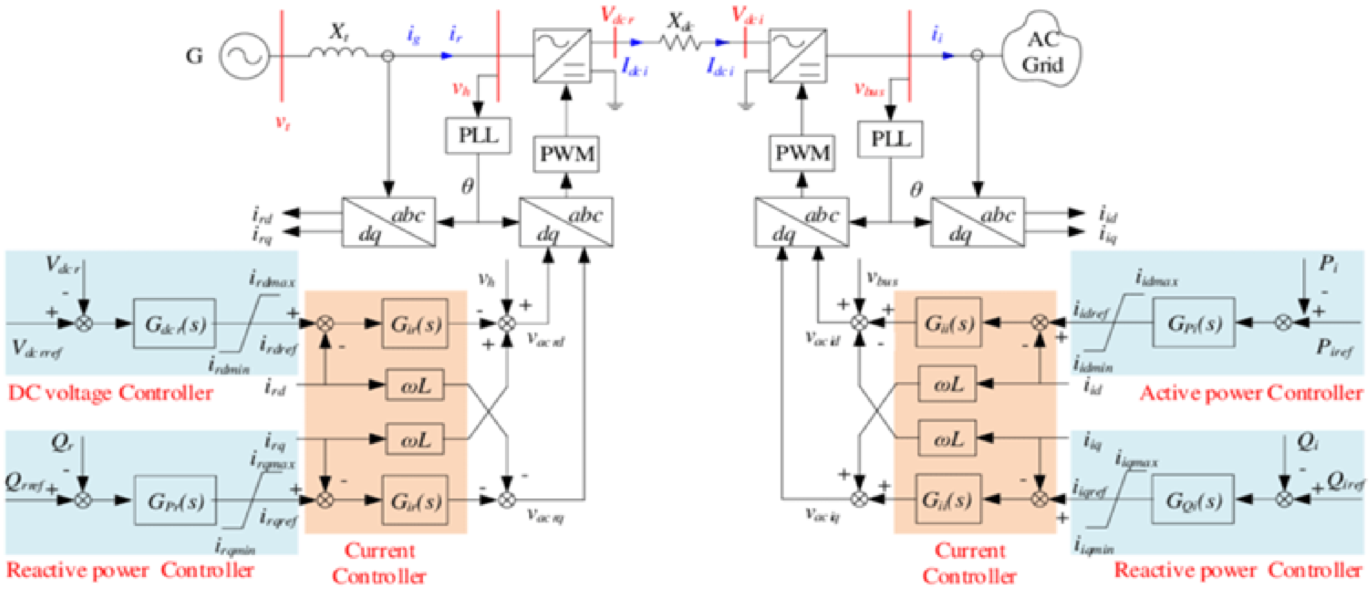


Fig.1TheschematicdiagramofDCnetworkwithdualterminal

3.CONTROLSTRATEGY

Conventional Control Strategy for Network Bus Voltage:

The nodes connected to different categories of network components have varying operating characteristics, according to the classification of network elements indicated above.

Flexible voltage control with DESS:

The full range of operating characteristics and control goals for various interfaces are considered. The electricity flowing from microgrids or the AC utility grid to the DC network is regarded to be in the charge state, while the inverse power flow is in the discharge state. The electrical properties of items interfaced to the DC network, such as the frequency of the AC grid and the voltage of the DC grid, are described by the inner features.

4.FUZZYMETHOD

In recent years, the number of fuzzy logic applications has increased considerably. Consumer electronics such as cameras, camcorders, washing machines, and microwave ovens are among the applications, as are industrial process control, medical instrumentation, decision-support systems, and portfolio selection.To see why fuzzy logic is becoming more popular, you must first comprehend what fuzzy logic is. There are two main interpretations of fuzzy logic.Fuzzy logic is an extension ofmultivalve logic in a strict sense. In a broader sense, however,fuzzy logic (FL) isessentiallysynonymous of the theory of fuzzy sets, that deals with membership determined by degree.Foundations of Fuzzy Logic explains the fundamental concepts that underpin FL in a clear and understandable manner. It's worth emphasising that the core concept behind FL is that of a linguistic variable, or one whose values are words rather than numbers. FL can be thought of as a way of calculating with words rather than numbers in many ways. Despite the fact that words are fundamentally less precise than numbers, they are easier to use. Furthermore, computing with words makes use of the tolerance for imprecision, which reduces the cost of the answer. Dealing with uncertain outcomes and antecedents requires a mechanism.

SIMULATIONOUTCOMES

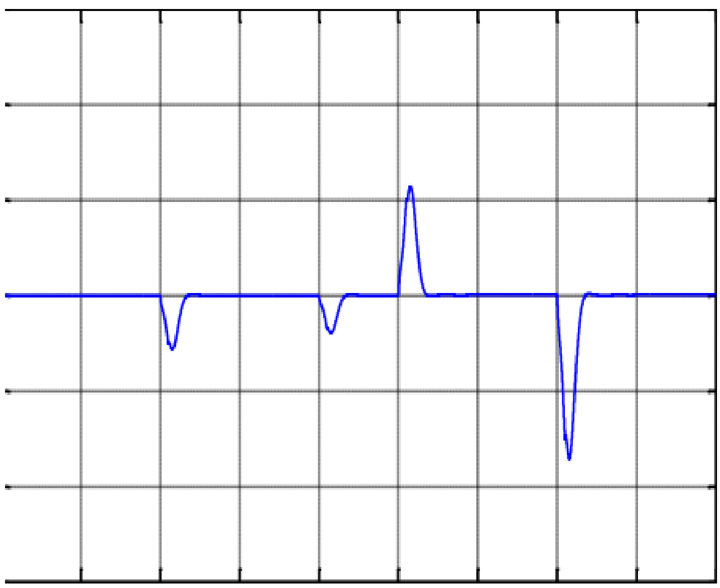


Fig.3 SOC

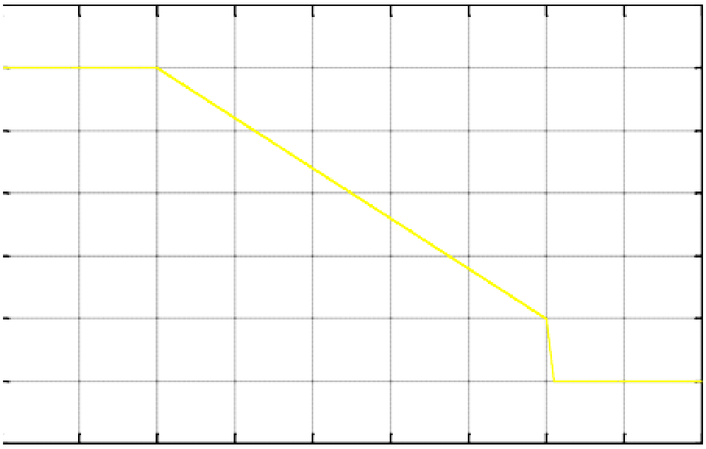
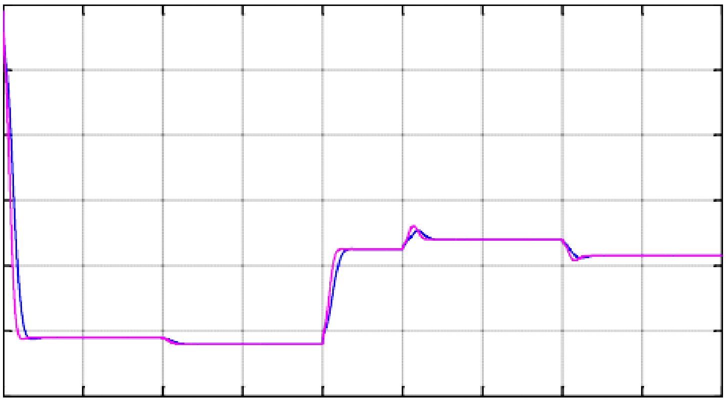


Fig.4NetPower



5.CONCLUSION

In this study, the suggested approach of flexible voltage control is shown to have a higher ability to control DES units in a DC distributed network. The recommended strategy was used in a variety of networks, and in all cases, the proposed technique provided efficient results. Furthermore, under exhibited virtual inertia and capacitances, the parameters of the AC and DC networks are briefly evaluated. The proposed control technique for the DES, which is located at the AC microgrid or network terminal bus, is based on interactive features, which allows the DES to respond to both DC network voltage variations and utility AC grid frequency changes.

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