SCHOLARLY PUBLICATIONS
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Journal Name: IEEE Transactions on Industrial Informatics **IF: 11.7**

Title: An Enhanced Protective Relaying Scheme for TCSC Compensated Line Connecting DFIG-Based Wind Farm

Author: Mohanty S.K., Nayak P.K., Bera P.K., Alhelou H.H.

Details: March 2024

Abstract: The electricity generated from the present-day large capacity doubly fed induction generator (DFIG) installed wind farm is generally transmitted to utility grid via medium or high voltage transmission line (TL). Due to the restriction of building new TLs, series compensated TLs are some cases preferred for such applications. But, the nonlinear output power versus wind speed relation, control strategies of power electronic interfaced DFIG-wind turbine generators and the nonlinear operation of the thyristor-controlled series capacitor (TCSC) during fault impose adverse impact on the performance of the conventionally used distance relaying-based TL protection schemes. In this article, an improved fault detection and classification technique is proposed to assist distance relay in ensuring fast and reliable protection to TCSC compensated TL linked to DFIG-installed wind farm. In this method, a feature called transient monitoring indexed (TMI) is derived from the measured three-phase currents at the relay location for fault detection and TMI-assisted support vector machine is employed further for fault classification. Performance of the proposed scheme is validated on various fault and nonfault transients simulated on a test power system through MATLAB/Simulink. This protective scheme is farther validated throughout real-time assembled dSPACE DS 1104 control prototype hardware. The superiority of the proposed method is also demonstrated through comparative assessment results with few existing techniques. The overall results justify the merits of the proposed method for fast and accurate detection and classification of faults in such crucial TLs.

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Journal Name: IEEE Transactions on Power Delivery **IF: 3.8**

Title: Autoregressive Coefficients Based Intelligent Protection of Transmission Lines Connected to Type Farms

Author: Bera P.K., Kumar V., Pani S.R., Malik O.P.

Details: Volume 39, Issue 1, February 2024

Abstract: Protective relays can mal-operate for transmission lines connected to doubly fed induction generator (DFIG) based large capacity wind farms (WFs). The performance of distance relays protecting such lines is investigated and a statistical model based intelligent protection of the area between the grid and the WF is proposed in this article. The suggested method employs an adaptive fuzzy inference system to detect faults based on autoregressive (AR) coefficients of the 3-phase currents selected using minimum redundancy maximum relevance algorithm. Deep learning networks are used to supervise the detection of faults, their subsequent localization, and classification. The effectiveness of the scheme is evaluated on IEEE 9-bus and IEEE 39-bus systems with varying fault resistances, fault inception times, locations, fault types, wind speeds, and transformer connections. Further, the impact of factors like the presence of type-4 WFs, double circuit lines, WF capacity, grid strength, FACTs devices, reclosing on permanent faults, power swings, fault during power swings, voltage instability, load encroachment, high impedance faults, evolving and cross-country faults, close-in and remote-end faults, CT saturation, sampling rate, data window size, synchronization error, noise, and semi-supervised learning are considered while validating the proposed scheme. The results show the efficacy of the suggested method in dealing with various system conditions and configurations while protecting the transmission lines that are connected to WFs.

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SCHOLARLY PUBLICATIONS
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Journal Name: Heliyon **IF: 3.4**

Title: Performance analysis of DFIG support microgrid using GA optimized restricted Boltzmann Machine algorithm

Author: Bhol R., Swain S.C., Dash R., Jyotheeswara Reddy K., Dhanamjayulu C., Kotb H., Emara A.

Details: Volume 10, Issue 10, May 2024

Abstract: Voltage and reactive power regulation in a deregulated microgrid can be achieved by strategically placing the Static Synchronous Compensator (STATCOM) in coordination with other renewable energy sources, thus ensuring high-end stability and independent control. STATCOM plays a crucial role in effectively addressing power quality issues such as voltage fluctuation and reactive power imbalances caused by the intermittent nature of wind energy conversion systems. To successfully integrate STATCOM into the existing system, it is essential that the control system employed for STATCOM coordination aligns with the Doubly-Fed Induction Generator (DFIG) controller within the microgrid. Therefore, an efficient control algorithm is required in the microgrid, capable of coordinating with the DFIG controller while maintaining system stability. The utilization of a Genetic Algorithm (GA) in calibrating the Restricted Boltzmannn Machine (RBM) can streamline the process of determining optimal hyperparameters for specific tasks, eliminating the need for computationally intensive and time-consuming grid searches or manual tuning. This approach is particularly advantageous when dealing with large datasets within short time durations. In this research, a Simulink model comprising a DFIG-based microgrid and STATCOM has been developed to demonstrate the effectiveness of the proposed control system using RBM in managing STATCOM and facilitating microgrid operations.

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