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Reliable modular multilevel converters for high-voltage direct transmission

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Modular Multilevel Converter (MMC) has become the most attractive multilevel converter topology for medium- and high-power applications, especially for the High-Voltage Direct-Current (HVDC) transmission system. In comparison with the two-level and three-level voltage source converter topologies, the MMC is more competitive with a number of advantages such as modularity, scalability, high efficiency, superior harmonic performance, etc. Reliability is one of the most important challenges for MMCs based HVDC systems, where a large number of power switching devices are used and each of these devices may be considered as a potential failure point. So, it is essential to detect and locate the fault after its occurrence. The underlying reason is that the fault may distort the voltage and current in the MMC, even destroy the MMC and consequently disrupt the operation of the MMC. In this presentation, a fault detection and localization method is proposed for the MMC to improve reliability. The Kalman Filter (KF), which is well-known for dealing with dynamic systems corrupted by uncertainties caused by different types of noise, is applied primarily to MMCs for fault detection. Through the comparison between the measured state value and the estimated state value by KF, the MMC fault can be detected. Based on the failure characteristics of the MMC, a fault localization method is derived for the MMC, which can effectively and precisely locate the faulty modules. In addition, the fault tolerant control of the MMC is also presented for the normal operation of the system under faults.

Biography

Fujin Deng has completed his PhD and Post-doctoral research in Energy Technology from the Department of Energy Technology, Aalborg University, Aalborg, Denmark, in 2012 and 2015, respectively. Since 2015, he is an Assistant Professor in the Department of Energy Technology, Aalborg University, Denmark. He has published 20 papers in reputed journals. His main research interests include wind power generation, multilevel converters, DC grid, high-voltage direct-current technology, and offshore wind farm-power systems dynamics.

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