



Fault Detection, Location, Isolation and Reconnection in Low-Voltage DC Distribution System

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Background

Small-scale low-voltage distribution systems, such as a microgrid, have many advantages to traditional AC distribution systems. Although AC-bus based systems can readily use the existing AC power grid technologies, grid issues including synchronization, reactive power control, and bus stability are inherited as well. DC-bus based systems can be a feasible solution because they are small, localized systems that cause the transmission loss to be negligible. Moreover, it does not need to consider the AC system issues, and cost and size can be reduced.

On the other hand, the DC microgrid has challenges, such as protection of the systems, because it is much more difficult to interrupt the fault current in a DC system than in an AC system. The protection devices commercially available for low-voltage DC-bus systems are fuses and circuit breakers. However, most of the existing protection schemes disconnect the source from the faulted system, so the whole system has to be shut down.

Technology

A University of Colorado research team led by Jae-Do Park has developed a fault detection, location and isolation scheme for a low-voltage DC-bus microgrid system, which detects the fault in a bus segment between devices, then locates and isolates the faulted section so that it keeps operating without disabling the entire system. This scheme can protect the DC distribution system from line-to-ground and line-to-line fault by fault isolation and quick fault current extinction. Furthermore, it can handle the bidirectional power flow of the faulted bus.

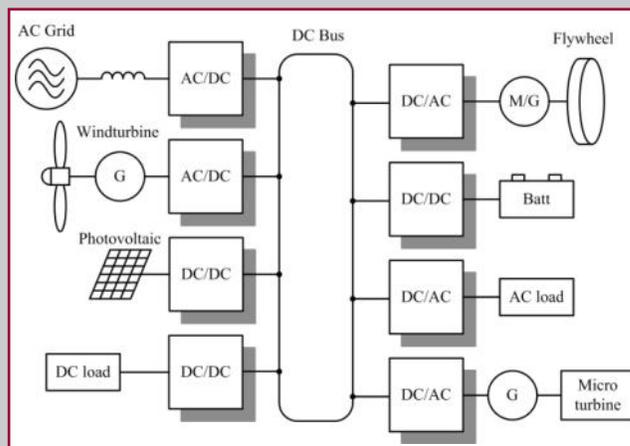


Figure: Conceptual diagram of a DC distribution system

Key Documents



[Fault Detection and Isolation in Low-Voltage DC-Bus Microgrid System](#). IEEE Transactions on Power Delivery, Vol. 28, No. 2, pp. 779-87, April 2013. PDF available upon request.

[DC Ring-Bus Microgrid Fault Protection and Identification of Fault Location](#). IEEE Transactions on Power Delivery, Vol. 28, No. 4, pp. 2574-84, Oct. 2013. PDF available upon request.

“Fault Detection, Isolation, Location and Reconnection Systems and Methods.” U.S. patent application, priority date Apr. 27, 2012; available under CDA.

“Fault Location Method Using A Power Probe Unit.” Provisional application filed March 12, 2013; available under CDA.