



Protection System for Power Flow Controller

Generic solution for interline PFC devices embedded in HVDC grids

CONTEXT

The Power Flow Controller (PFC) will take a crucial role in the expansion of the future meshed MTDC systems. Indeed, PFC provide a new degree freedom to control the flowing power patterns in a meshed HVDC system. The use of PFC will contribute to increasing the operating area of the networks by giving more flexibility and better controllability of meshed MTDC networks. Several PFC concepts are proposed in the literature. The most promising solutions are based on interline power flow controllers which are medium-voltage converters connected in series with links.

In regard to the meshed MTDC system operations, PFC devices will withstand the rated HVDC converter station current and Medium Voltage (MV) level across it even if it is embedded in a High Voltage (HV) system. However, HVDC fault events lead to very high overcurrents and overvoltages on the PFC devices which need to be protected.

TECHNOLOGY DESCRIPTION

A generic protection system for interline power flow controllers is proposed. An effective protection algorithm manages and coordinates the PFC controllable switches and protection switches in the fault operations. The principle of the PFC protection system is based on the by-pass of uncontrollable PE switches for current protection while the voltage protection is guaranteed by the OverVoltage Limitation (OVL) devices across the voltage source and/or across the PFC itself. If required, Rate of Rise OverCurrent Limitation (OCL) devices are added.

Several designs are possible for protective equipment of the proposed generic protection system. The by-pass protection switches can be designed as thyristors which can act quickly after the detection of a fault and withstand very high fault currents. Surge arresters, with their ability to limit overvoltages can be used as OverVoltage Limitation (OVL) devices. The same technology of smoothing reactors is adequate to play the role of OverCurrent Limitation (OCL) devices.

A main sequence algorithm and its back-up have also been developed to coordinate all sequences and procedures during fault transients. Based on the proposed protection solution, the PFC still remain a cost effective solution since it is designed as a MV device.

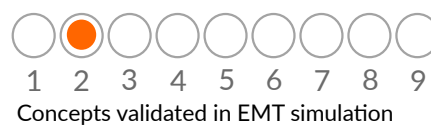
APPLICATION DOMAIN

Interline Power Flow Controllers

ADVANTAGES

Keep the design of the PFC device at MV level.
Decrease the cost of the design.

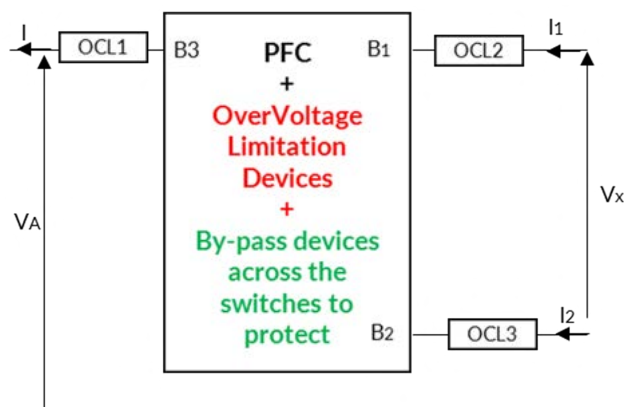
TRL SCALE



DELIVERABLES

Patent application FR1855652 + PCT
Technical reports

Principle of PFC protection principle



Example of PFC protection design

