



Optimized insertion resistor

Cable voltage restoration after DC fault clearing

CONTEXT

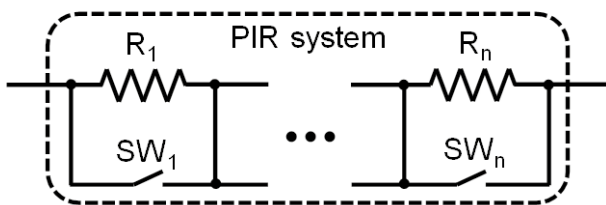
Grid protection is a capital part of power systems design. For HVDC systems, the protection strategy has to clear the DC fault and restore the power in the grid as soon as possible so that the connected AC grid is not negatively impacted. In this context, the advantage of non-selective protection strategies is that no ultra-fast circuit breakers or identification algorithms are needed for the fault current suppression. However, the main drawback is that no power is transferred through the HVDC system for a certain lapse of time.

Fast restoration of HVDC power transmission requires in the first place a fast process to restore HVDC cables voltage. The Optimized Insertion Resistor enables such a fast voltage restoration in cables system, while avoiding inrush currents that would exceed half-bridge MMC IGBTs capability.

TECHNOLOGY DESCRIPTION

The Optimized Insertion Resistor is a DC making switch, with closing resistors. Closing sequence consists of at least three steps:

- In-rush current is first limited by a resistor R_1+R_2
- R_1 is then by-passed in order to accelerate cable charging near-completion, while R_2 still limits in-rush current
- The entire resistor is then by-passed



Topology of the PIR

APPLICATION DOMAIN

- Multi-terminal DC grid
- Bipolar & monopolar configuration
- Cable or mixed OHL/cable system

ADVANTAGES

- Fast voltage restoration of DC grid after fault.
- Smooth closing operation which avoids high inrush current exceeding converter short-time withstand current capability.

TRL SCALE



EMT simulation work (included in protection system virtual mock-ups).

Technology development not started

DELIVERABLES

Patent WO2018115753 (A1)

SCIENTIFIC REFERENCE

PROMOTION Deliverable 4.2

A. Bertinato, J.C. Gonzales, et. al. "Development of a protection strategy for future DC networks based on low-speed DC circuit breakers" CIGRE Paris 2018.

Fast voltage restoring and limited inrush current using the proposed PIR

