



MV & HV DC Circuit Breaker

CONTEXT

Direct Current Circuit Breaker (DCCB) is a device which interrupts the Direct Current and eliminates a fault in a High Voltage transmission network or Medium Voltage distribution network. It has a low conduction loss in closed position and necessary to rapidly interrupt a fault current to avoid the shutdown of AC to DC converter in the network or to interrupt a load current in case of reconfiguration of network.

In contrast to an AC circuit breaker that interrupts a current at its natural current zero every half cycle, a DCCB should create an artificial current zero with the assistance of an auxiliary circuit to interrupt the electric arc formed between the contacts of a mechanical switch. The design uses the intrinsic interruption capability of arc at zero-crossing under a moderate rate-of-change of intensity in order to commutate the network current into an energy absorption device that decreases the current to zero.

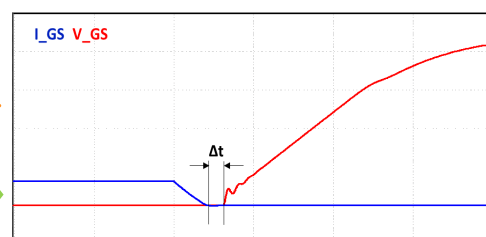
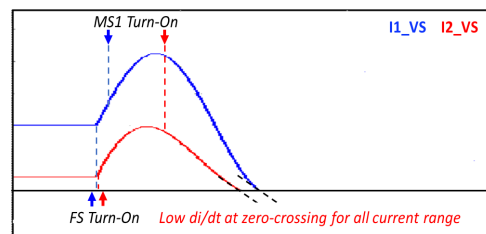
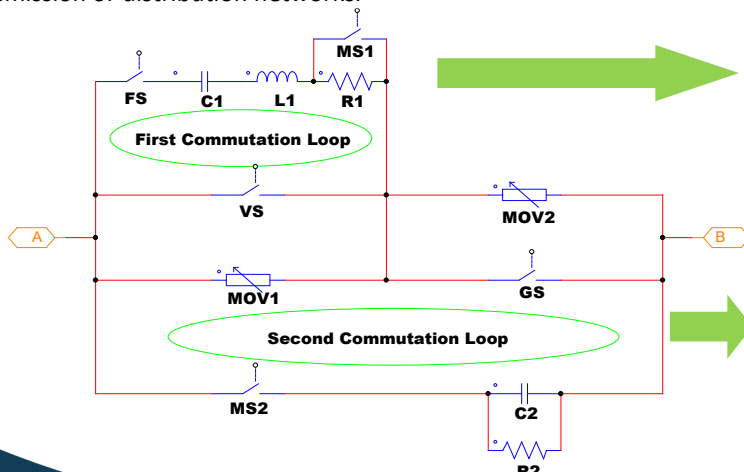
The drawback of so-called 'Hybrid DCCB' is its high conduction loss in the load current path caused by semiconductor switches. The drawback of another so-called 'active current injection DCCB' is the high probability of reignition, especially for interruptions of a load current. Moreover, it requires a bulky High Voltage capacitor and inductor in its auxiliary circuit.

TECHNOLOGY DESCRIPTION

The first patent addresses an architecture of a MVDC circuit breaker. This patent introduces a time-controlled resistor module in the auxiliary circuit. This module short-circuits a resistor 'R1' by closing a by-pass switch 'MS1' for controlling the insertion time to limit the rate-of-change of current at its zero crossing and ensuring a fast interruption. It contributes to a compact and cost-efficient DCCB.

The other patent introduces an architecture of a HV DCCB based on the previous MV DCCB architecture. It exploits the phenomenon that a current commutation from a surge arrester 'MOV1' to a capacitor 'C2' can generate an extended recovery period ' Δt ' without arc to secure the interruption of current. It avoids the use of HV inductor and reduces the volume of HV capacitor.

The DCCBs according to the patents are bidirectional devices having a current interrupting capacity greater than 20 kA with a reasonable size and at a moderate cost. As a result, such DCCBs can be used in meshed transmission or distribution networks.



APPLICATION DOMAIN

- MVDC network protection : distribution, industrial, railway
- HVDC network protection : transmission

ADVANTAGES

- Low conduction losses
- Cost optimized and footprint reduced
- Load and fault current interruption
- Easy to adapt to client requirements

TRL SCALE



Interruption validated over full current range on prototype

DELIVERABLES

Patent pending : WO2020136340, WO2020136350

Design consultancy and prototyping