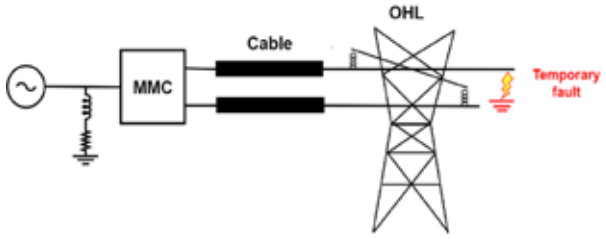
Fast earthing switch for floating MMCs

An adaptation of the strategy for HVDC lines fast re-energization using half-bridge MMC internal energy for symmetrical monopoles

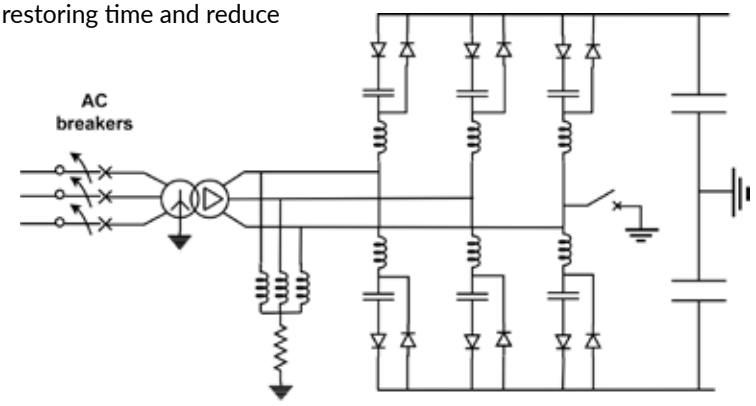
CONTEXT

In a HVDC point-to-point link comprising a section of OHL the majority of pole to ground faults can be considered as a non-permanent faults. Therefore, fast reconnection of the link must be considered in order to restore the power as soon as possible.
After clearing of the fault by opening the AC breakers, a common solution to discharge the pole voltages is through resistors installed at the DC side of the converter and to recharge them through pre-insertion resistors.
A method for fast re-energization of HVDC lines using half-bridge MMC internal energy has already been proposed by SuperGrid Institute. In order for it to be applicable to symetrical monopole configurations, the need for an additionnal earthing switch within the MMC has been patented.



TECHNOLOGY DESCRIPTION

An earthing switch is installed in one phase (AC side) of the MMC converter between the upper and lower arm. In normal operation the switch is open.
In case of pole to ground fault, after opening of the AC breaker the earthing switch can be closed. It is then possible to control separately the positive and negative pole to ground voltages. The healthy pole to ground voltage can be rapidly discharged to 1pu, by transferring the energy stored in the line stray capacitance into the SM capacitors.
After the de-ionization time is elapsed, the faulty pole to ground voltage can be controlled and restored to 1pu. This operation can be repeated several time in case the fault is still present.
Once the voltage is reestablished the AC breaker can be reclosed and power restored. This solution could speed up the restoring time and reduce it up to 0.3-0.5s.



APPLICATION DOMAIN

Point to point HVDC connection (symetrical monopole with an OHL portion)
Also applicable to cable-based symetrical monopole MTDC grids

ADVANTAGES

- Grounding switch at one arm, necessary to fix a ground reference
- Internal MMC energy used to rebalance the link voltage
- No need for discharge or closing resistors
- Fast power restoration after a DC fault (300ms)
- Capability to check smoothly check voltage recovery

TRL SCALE

EMT simulation work.

DELIVERABLES

Patent appl. FR1871143 (+ FR1753433)
Virtual mock-ups
Training, technical support

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