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Analysis on Operational Characteristics of Double Quench Flux Lock type Superconducting Fault Current Limiter

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1. Introduction

- The SFCL(Superconducting Fault Current Limiters) has many advantages.
- Recently, various configuration of the SFCL are reported.
- Among them, the double quench type SFCL has been studied in order to reducing the burden of the HTSC(High-Temperature Superconducting) elements.

Research Motivation

- The design of the series connected normal resistance for the control of distributed fault current is very important.
  → It is difficult to change the specification of the HTSC elements and normal resistance according to change of the power system.
- In addition, both HTSC elements of the double quench type SFCL were sequentially quenched by series connected normal resistance.

Research Purpose

- This paper proposed the double quench flux lock type SFCL which combine the double quench type SFCL and the flux lock type SFCL.
  → To improve the disadvantage of double quench type SFCL.

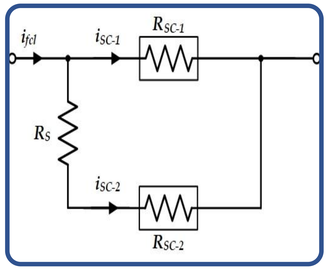


Fig. 1. Configuration of the double quench type SFCL.

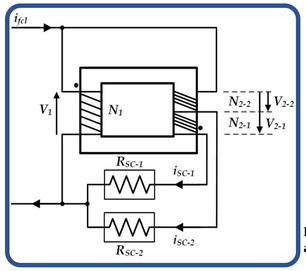


Fig. 2. Configuration of the double quench flux lock type SFCL.

2. Modeling of SFCL

- The double quench type SFCL consists of the normal resistance(Rs) and both HTSC elements(Rsc-1, Rsc-2).
- The design of the normal resistance to distribute the fault current is very important.
- The double quench flux lock type SFCL consists of an iron core, two coils and the HTSC elements.
- The burden of the HTSC elements could be controlled by using the turn ratio(N2-1/N2-2).
- In the higher turn ratio, the induced voltage and the burden of the second HTSC element was more reduce than the first HTSC element.
- The HTSC elements were simultaneously quenched on the double quench flux lock type.

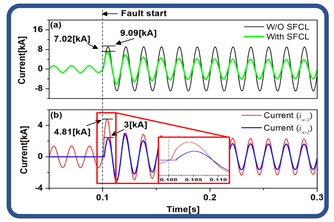
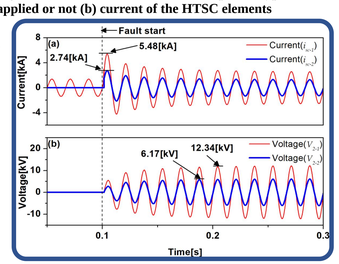
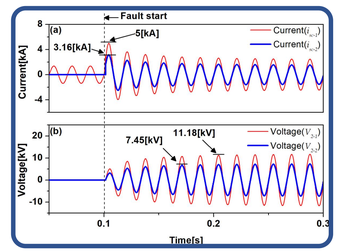


Fig. 3. (a) Fault current when double quench type SFCL was applied or not (b) current of the HTSC elements





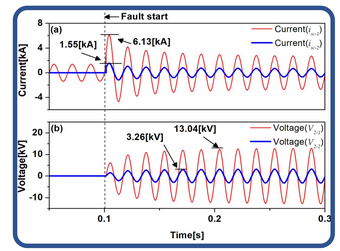


Fig. 4,5,6. (a) fault currents of the HTSC elements (b) voltage of the HTSC element 4(turn ratio=2); 5(turn ratio=1.5); 6(turn ratio=4).

3. Simulation Results

- The fault current was limited when the double quench type
  → The HTSC elements were sequentially quenched. (Fig.3)
- The burden of the HTSC elements in double quench flux lock type SFCL distributed according to the turn ratio.
  → The HTSC elements were simultaneously quenched. (Fig. 4,5,6).
- The double quench flux lock type SFCL could distribute the burden of the HTSC elements according to turn ratio.

4. Conclusion

- This paper proposed the double quench flux lock type SFCL.
  → To improve the operation characteristics.
- It keeps the advantage characteristics of both the SFCLs
- Proposed SFCL model with easy design method and effective operation in various power system.

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