MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **638** Type: **Poster Presentation**

Mon-Af-Po1.16-06 [49]: Working principle analysis and Parameter optimization of snubber circuit applied in 100kA quench protection system

Monday 23 September 2019 14:30 (2 hours)

Quench protection system aims to protect superconducting magnets in Large Superconducting Fusion Device (LSFD) from long time and severe conducting current. A 100kA super-high pulse current with very short pulse width produced by LC commutation circuit, flows reversely into the Vacuum Circuit Breaker (VCB) to force the magnets current cross zero, which ensures the reliable turn-off of VCB to protect the superconducting magnets. However, the large current change rate of the pulse current and the stray inductance of external circuit will generate extremely high overvoltage on the both end of VCB, which may result in the turn-off failed and shortened life of VCB. As the result, a snubber circuit consisted of snubber capacitor and snubber resistor is applied to mitigate the overvoltage of VCB.
In this paper, the producing reason of overvoltage of VCB is analyzed firstly. Then, the calculation and the theoretical analysis of transient process are given to illustrate the overall work principle of snubber circuit. And a series of simulations by using Matlab is presented to verify the correctness of the above analysis. In addition, in order to consider the performance and cost of the snubber circuit at the same time, the genetic algorithm is proposed to obtain the optimal parameters of the snubber circuit. At last, both simulation and theoretical analysis indicate that this set of parameters can greatly mitigate the overvoltage of VCB at a relatively lower cost.

Authors: Dr TONG, Wei (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China; Science island Branch, University of Science and Technology of China, Hefei, 230026, China.); Prof. SONG, Zhiquan (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China); FU, Peng (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China); Dr LI, Hua (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China); Dr WANG, Kun (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China; Science island Branch, University of Science and Technology of China, Hefei, 230026, China); Dr LI, Chuan (International Joint Research Laboratory of Magnetic Confinement Fusion and Plasma Physics, Huazhong University of Science and Technology, Wuhan, 430074, China)

Presenters: Dr TONG, Wei (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China; Science island Branch, University of Science and Technology of China, Hefei, 230026, China.); Prof. SONG, Zhiquan (Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, 230031, China); Dr LI, Chuan (International Joint Research Laboratory of Magnetic Confinement Fusion and Plasma Physics, Huazhong University of Science and Technology, Wuhan, 430074, China)

Session Classification: Mon-Af-Po1.16 - Quench Protection and Detection Systems II