

This paper proposes a hybrid static synchronous compensator (hybrid-STATCOM) in a three-phase power transmission system that has a wide compensation range and low dc-link voltage. Because of these prominent characteristics, the system costs can be greatly reduced. In this paper, the circuit configuration of hybrid-STATCOM is introduced first. Its V-I characteristic is then analyzed, discussed, and compared with traditional STATCOM and capacitive-coupled STATCOM (C-STATCOM). The system parameter design is then proposed on the basis of consideration of the reactive power compensation range and avoidance of the potential resonance problem. After that, a control strategy for hybrid-STATCOM is proposed to allow operation under different voltage and current conditions, such as unbalanced current, voltage dip, and voltage fault. Finally, simulation and experimental results are provided to verify the wide compensation range and low dc-link voltage characteristics and the good dynamic performance of the proposed hybrid-STATCOM.