

This paper proposes a novel modular multilevel dc-dc converter intended for transforming dc voltage and interconnecting dc grids for medium-voltage networks. The converter is composed by two strings of submodules, each of which consists of an upper arm and a lower arm with their middle points crossly connected through a dc capacitor. With assistant of the cross-connected capacitors, dc and ac power loops are formed for the dc-dc converter, leading to the power balance between primary and secondary sides, as well as between upper and lower arms. The avoidance of transformer brings the favorable features of low cost and light weight to the proposed dc-dc converter. In order to guarantee the normal operation of the dc-dc converter, a control strategy with focus on converter power balance control is presented. Simulation performed in MATLAB/SIMULINK validates the operation principle of the dc-dc converter. Experimental results obtained from a 300-V 3.6-kW downscaled laboratory prototype also prove the effectiveness of the proposal.