

Modular Harmonic Cancellation in a Multiplier High Voltage Direct Current Generator

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Abstract : Generation of high DC voltages is necessary for testing the insulation material of high voltage AC transmission lines with long lengths. The harmonic and ripple contents of the output DC voltage supplied by high voltage DC circuits require the use of costly capacitors to smooth the output voltage after rectification. This paper proposes a new modular multiplier high voltage DC generator with embedded Cockcroft-Walton circuits that achieve a negligible harmonic and ripple contents of the output DC voltage without the need for costly filters to produce a nearly constant output voltage. In this new topology, Cockcroft-Walton modules are connected in series to produce a high DC output voltage. The modules are supplied by low input AC voltage sources that have the same magnitude and frequency and shifted from each other by a certain angle to eliminate the harmonics from the output voltage. The small ripple factor is provided by the smoothing column capacitors and the phase shifted input voltages of the cascaded modules. The constituent harmonics within each module are determined using Fourier analysis. The viability of the proposed DC generator for testing purposes and the effectiveness of the cascaded connection are confirmed by numerical simulations using MATLAB/Simulink.

Keywords : Cockcroft-Walton circuit, harmonics, ripple factor, HVDC generator

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