High performance control strategy for single-phase three-level neutral-point-clamped traction four-quadrant converters

Operational data from Chinese railways indicate a number of challenges for traction four-quadrant converter (4QC) control including low-order voltage and current harmonics and reference tracking. A control strategy for a single-phase three-level neutral-point-clamped 4QC employed in the electric multiple unit traction system is proposed in this study. The strategy is based on a multiple frequency tuned quasi-proportional resonant controller in the ac-side current loop and a multiple frequency tuned notch filter in the dc-link voltage loop. Under the typical supply voltage distortion present in the network, the proposed control strategy improves the current tracking performance and reduces the line current harmonics, when compared with conventional control strategies. Experimental results, both under purely sinusoidal and distorted supply voltages, validate the effectiveness of the proposed control strategy.

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