

Improving the Efficiency of Traction Systems Through Inverter Voltage Waveform Optimization

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In recent railway traction systems, squirrel-cage induction motors are commonly used as traction motors. They are usually driven by a voltage source inverter with a one-pulse waveform at high speed range. The one-pulse waveform contains lower harmonics that induce additional loss in the motors. Therefore, we are studying the optimization of three-pulse and five-pulse waveforms that can substitute the one-pulse waveform and reduce the additional loss. In this paper, we propose three-pulse and five-pulse waveforms that are optimized so that we can minimize the additional loss while maximizing the fundamental component. The effectiveness of the proposed waveforms is verified through finite element analyses. The results show that the proposed waveforms can improve the motor efficiency by about one percent compared with the one-pulse waveform.