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Design, Analysis, and Optimization of a Multi-Speed Powertrain for Class-7 Electric Trucks

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Abstract

The development, analysis, and optimization of battery electric class-7 heavy-duty trucks equipped with multi-speed transmissions are discussed in this paper. The designs of five new traction motors—fractional-slot, concentrated winding machines—are proposed for use in heavy-duty electric trucks. The procedure for gear-ratio range selection is outlined and ranges of gear ratios for three-to six-speed transmission powertrains are calculated for each of the proposed electric traction motors. The simulation and gear-ratio optimization tasks for class-7 battery electric trucks are formulated. The energy consumption of the e-truck with the twenty possible powertrain combinations is minimized over the four driving cycles and the most efficient powertrain layouts that meet the performance criteria are recommended.
References


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