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Integrated Starter-Alternator Control System for Automotive

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Abstract

This paper develops a control system for an Integrated Starter Alternator (ISA) used in hybrid electric vehicles. ISA employs a permanent magnet synchronous machine with voltage source inverter, using field oriented vector control with torque reference. The motor/generator mode is given by the torque reference selecting with a switch an external torque (for motor mode) or a torque delivered by a dc voltage loop to charge the battery (for generator mode). The internal combustion engine is simulated by a DC motor with speed control, and the battery is managed by using the ISA active power. The simulation results, based on real scenarios, prove the ability of the proposed ISA control system to work in motor and generator modes with smooth transition between them. The scenarios include the motor mode with starting and added demanded mechanical torque, and the generator mode to charge the battery up to 42 V, with good dynamic responses.

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