Autonomous Control of Variable Speed Three Phase Induction Motor Drive for Electric Vehicles and Aerospace Applications

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Abstract:
Induction motor drives are widely used in variable speed applications in electric vehicles, and avionics. Due to advances in power-electronic switching devices, it is possible to control the speed of an induction motor. The microcontrollers are programmed with a unit sine curve for the 1st 256 locations. By addressing the microcontroller at different speeds, various sine-frequency outputs can be generated. Since the microcontroller's output is digital, an appropriate digital to analogue converter is used to get sine wave. This voltage is being modulated with a high carrier frequency. A comparator compares the pulse width modulation output with the feedback voltage from the current transformer motor terminals. This comparator output is given to the D-flip-flop to get 2 complementary outputs for the inverter legs. Similarly, for all 3 phases, control voltages are generated, and the outputs are passed through appropriate dead-zone generators, which are then applied to the MOSFET gates. Suitable opto-couplers are used to isolate the control signal from high voltages. The inverter output is given to the motor terminals. Current Transformers are used for each phase and fed back to the comparator for control purpose. The system has been tested for various frequencies from 30 - 62.5Hz. The mixed signal oscilloscope records the phase, line voltages across motor terminals and the snubber inductor waveforms in bitmap format. The result shows that there is no overshoot at the terminal voltage of phase and line at all the speeds of induction motor due to proper snubber circuits.

keywords:
Pulse width modulation, sine modulation, induction motor, Fast Fourier transformation.