Torque Ripple Minimization in Switched Reluctance Motor by Using Artificial Neural Network

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Abstract:
This article presents switched reluctance motor (SRM) with an artificial neural network (ANN). The SRM motor is an electronically controlled motor like a BLDC motor. The motor required a power electronic converter for controlling stator poles. The main advantages of SRM motor are low cost, a low-temperature effect due to no winding on the rotor, easy manufacturing design, it operates at high speed, and high efficiency. The main disadvantage of the SRM motor is torque ripple and noiseThis paper ANN-based SRM implemented for torque ripple minimization. The simulation results are verified in MATLAB/Simulink software. The verified results are motor speed, torque, current, and flux. The performance of SRM compared with Hysteresis Current Controller (HCC) and ANN controller. ANN-based SRM results are the best performance during motor starting and running conditions. The main outcomes of this paper are reducing starting torque and torque ripple minimization and reducing starting current and running current.

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Contents

EV motors are mainly classified into two types one is commutator and commutator-less motors. All DC motors are commutator motors. These commutator motors are not suitable for four-wheeler applications, due to low torque density and low speed. Presently there are two types of motors used in EV applications BLDC and SR Motor. The SRM motor has many advantages such as low cost, lowtemperature effect, high power capability, and manufacturing time low. This paper [1] proposed Direct Torque instantaneous control (DTIC) used for reducing torque ripples in a 12/8 Switched reluctance motor. The DTIC controller minimized torque ripples and improved efficiency and speed. [2] This paper presented Improved Direct torque control with sliding mode control for minimizing the torque ripples in SRM drive. The sliding mode speed control (SMSC) reduces the response time and is better performed in reducing the torque ripples. A Novel Direct torque control (DTC) method is proposed [3] for reducing the torque ripples and power loss in a four-phase switched reluctance motor. The proposed method is well operated in steady state and dynamic conditions. This paper presented [4] –[10] the analysis of improved force linear switched reluctance motor for transit applications. To improve the force profile designed a parameter-based cumulative deterministic optimization algorithm (PBCDOA).This paper [5] proposed an ANNbased SR motor for torque ripple reduction and improved motor performance. To reduce the nonlinear problems such as stability, efficiency, and high speed the ANN-based SRM was performed in all conditions. Torque ripples are minimized in SR motor using the Dahlin cruise controller [6]. In reference [7] reviewed different SR motor current regulation control strategies as well as torque ripple minimization strategies. This article presents switched reluctance motor (SRM) with an artificial neural network (ANN). The SRM motor is an electronically controlled motor like a BLDC motor [12] –[14]. The motor required a power electronic converter for controlling stator poles. This paper ANN-based SRM implemented for torque ripple minimization. The simulation results are verified in MATLAB/Simulink software.

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