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Investigation on ANFIS-GA controller for speed control of a BLDC fed hybrid source electric vehicle

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Abstract

The BLDC (Brushless DC Motor) is utilized in electric vehicles, space missions, and mechanical applications. Neural Network Inference System reduces torque ripple for hybrid electric vehicle (PV-Battery) along with BLDC drive to achieve efficient speed performance and stability. A hybrid input source methodology is thus put forwarded to drive the stator currents giving exactly the expressed electromagnetic torque and counter-EMF harmonics. The torque and speed control technique are directed to neural network interference system, and H6 Voltage Source Inverter (H6 VSI) drives BLDC with a gate pulse signal. We examine how an ANFIS-GA torque controller may eliminate BLDC torque ripples under uninterrupted hybrid power supply in this work. MATLAB (Simulink) results show that Genetic Algorithm (GA) improves training of ANFIS better with varying set speed conditions. The ANFIS-GA controller outperforms challenging controllers under various BLDC motor driving load conditions, proving its efficiency.

Keywords: PV, Battery Pack, ANFIS, GA, H6 VSI, BLDC Motor

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1. Introduction

With the increasing popularity of electric vehicles (EVs) as a sustainable transportation solution, the development of efficient and reliable charging systems is of paramount importance. Among the various components of an electric vehicle, the motor plays a critical role in propulsion, and the BLDC has emerged as a preferred choice due to its high efficiency and excellent torque characteristics [1], [2]. It was reported that the costs of operating an electric vehicle are lower than the costs of operating a regular gasoline-powered vehicle. Because electricity is typically more affordable than either gasoline or diesel, this results in lower overall expenses for fuel. EVs also require less maintenance than traditional vehicles since they have less expensive components [3], [4]. It has been stated that the growth of infrastructure for charging electric vehicles has been a significant factor in the rising popularity of electric automobiles. The rapid growth of fast-charging stations has further reduced charging times of the vehicle which leads to guiding EV more applicable for long-distance travel. Efficient battery charging is eventual significance for electric vehicles (EVs) as it directly impacts their driving range, overall performance, and user experience [5], [6]. The driving range of an EV is determined by the capacity and efficiency of its battery. The increasing demand for electric vehicles (EVs) has led to significant advancements in motor technology, with BLDC emerging as a popular choice for EV propulsion systems [7].

BLDC motors offer high efficiency, compact size, and excellent torque characteristics, making them suitable for electric vehicle applications. Due to its high torque density and drive required a modest controller for its control, BLDC motors are currently being evaluated for a wide range of EV applications [8], [9]. Using back EMF data collected from a brushless DC motor, we show how