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Shouvik Mondal; Arindam Kumar Sil

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## Abstract

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## Abstract:

Electronic commutation, not brushes, powers a brushless DC motor (BLDC). It is used in HVAC, electric automobiles, industrial automation, and robotics. BLDC motors don't have brushes; thus, they last longer and need less maintenance. Speed control improves energy efficiency, performance, torque output, and noise. In this digital era, controllers must be discrete to avoid compromising system performance. If a continuous time controller is discretized using shift operator parameterization and exposed to high sampling frequency, it fails to provide meaningful results. In other hand, discrete controller design using delta operator parameterization overcomes the drawbacks of discretization using shift operator parameterization. In this paper the speed controller of BLDC motor is realized using delta operator parameterization and the discrete controller deigned in delta domain provides the same result as can be obtained using the corresponding continuous time controller, at very fast sampling rate. The performance of the discrete delta domain-based controller is compared with the performance of the discrete shift operator-based controller and continuous time controller, and the simulation results show that at a very fast sampling rate, the delta domain discrete controller outperforms the shift operator based discrete controller. The MATLAB /Simulink is used to get the results.

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#### I. Introduction

Controlling the speed of BLDC motors [1] is essential for maximizing energy economy, ensuring accurate operation, and responding appropriately to changes in load circumstances. Applications [2] such as industrial automation, robots, and electric cars are able to achieve their maximum potential as a result of their use. Through the management of torque output, speed control provides both steady operation and the protection of the motor. It lessens the dangers of overheating, vibration, and noise while also increasing the battery life of portable devices. Additionally, changing speeds make it possible to use regenerative braking, which contributes to an overall improvement in energy economy [3]. Because of these benefits, BLDC motors have found broad usage in a variety of sectors and gadgets. A PID controller [4], also known as a proportional-integral-derivative controller, is a popular method for managing a variety of applications, including the speed of brushless DC motors. There are several advantages to using a PID controller [5], some of the most important of which are noise reduction for the purpose of keeping the system stable, continuous control for the purpose of accurate error minimization and speed regulation, and strong adaptation to various operating situations. PID controllers, in the end, offer the requisite precision [6], responsiveness, and resilience needed for successful motor speed control. As a result, these controllers play a vital role in a variety of applications.

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