PDEOZE PowerContainer

Motor control with flywheel energy storage

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Overview

Abstract: Flywheel energy storage is a new technology of storing the mechanism energy,and this paper introduces the principle,structure and working mode of the flywheel energy storage system（FESS）.The core of the entire system is the motor control due to the charging and discharging process all achieved by the flywheel motor.This paper selects permanent magnet synchronous motor（PMSM） as the flywheel motor,and analyses the basic principle of vector control for PMSM and puts forward the charging and discharging strategy,and then adopts vector control method to realize the control of power-driven and power-generation,and with the help of PWM converter to finish the energy flowing between the DC bus and the motor sides.In the charging condition the DC bus supplies the power,and the PWM converter works as an inverter,and the control system drives the PMSM under the speed and current double-closed-loop strategy to accelerate the flywheel and store energy.In the discharging condition,the flywheel slows down because of its high inertia,and the PWM converter works as a converter,and the control system gets energy back to the DC side from motor side under the voltage and current double-closed-loop strategy.Meanwhile,the voltage regulation loop works to ensure that the voltage of the DC side doesn’t fall.To prove the feasibility and validity of the charging and discharging strategy for the FESS,this paper has finished the hardware and software designs based on DSP28335,and also some experiments have been carried out through the experiment platform.The experimental results show that the control strategy achieves good control effect in practical application.Is flywheel energy storage system a competitive solution?

A comprehensive review of control strategies of flywheel energy storage system is presented. A case study of model predictive control of matrix converter-fed flywheel energy storage system is implemented. Flywheel energy storage system comes around as a promising and competitive solution. Potential future research work is suggested.

What is the difference between SMO and Flywheel energy storage systems?

Most current research on SMO algorithms primarily focuses on motor control 30, whereas flywheel energy storage systems exhibit a more complex back-to-

back structure, high operational speeds of the flywheel and motor, large system inertia, fast charging and discharging rates, and frequent switching of control strategies 31, 32.

Why is Sensorless control technology preferred in flywheel energy storage system?

Therefore, sensorless control technology is preferred. Furthermore, the PMSM is the core of energy exchange in the flywheel energy storage system, and the accuracy and speed of the motor control strategy determine the overall charging and discharging control performance of the system.

Can a compact flywheel energy storage system eliminate idling loss?

Abstract: This article proposed a compact and highly efficient flywheel energy storage system (FESS). Single coreless stator and double rotor structures are used to eliminate the idling loss caused by the flux of permanent magnet (PM) machines. A novel compact magnetic bearing is proposed to eliminate the friction loss during high-speed operation.

What is the grid-side control strategy of the flywheel energy storage system?

Block diagram of the machine-side charge and discharge control of the flywheel energy storage system. The grid-side control strategy of the flywheel energy storage system combines grid voltage-oriented vector control and SVPWM (Space Vector Pulse Width Modulation) technology.

Can inverter drive control be applied to the flywheel energy storage system?

Most of the inverter drive control technologies can be adapted and applied to the charging and discharging control of the flywheel energy storage system, but they need to be modified and improved in conjunction with the operational conditions of the flywheel itself.

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