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SCHOOL OF ENGINEERING AND ADVANCED
TECHNOLOGY

Improved Control System for Dual Input- Dual Output DC-DC Converter

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Abstract

This thesis aims to propose a new control system of dual input dual output DC-DC converter by proposing the advanced fuzzy PID control system. The fuzzy PID controller is a type of intelligent control system being practically applying fuzzy logic theory. Compared with conventional control system, a properly designed fuzzy PID control system is more accurate, sensitive to input, robust to noise, large bandwidth, faster speed and constant oscillation. Therefore, the analysis of improved control system for dual input dual output DC-DC converter, comparison with conventional PID controller, and evaluation are the main focus of this thesis.

The improved control system for dual input dual output DC-DC converter is based on the PID control method and fuzzy logic theory. By the combination of conventional PID controller and fuzzy control theory, the advanced controller with human intelligence is produced. Fuzzy PID control method uses the present error E and EC , combined with the dynamic characteristics of controlled object and practical experience. According to the requirements and target functions, three parameters of PID controller are tuned online by fuzzy rules inference.

Simulation using MATLAB and SIMULINK and implementation with STM32f407 are presented. The optimization of improved control system for dual input dual output DC-DC converter is also studied.

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Abbreviation List

PV	photovoltaic
PID	proportional–integral–derivative controller
FPGA	field-programmable gate array
DCS	distributed control systems
PLCs	programmable logic controllers
VSLI	very large scale integrated
PWM	pulse-width-modulated
ARM	advanced RISC machine
MCU	microprocessor control unit
ZVS	zero voltage switching
DCM	discontinuous conduction mode
ZCT	zero current transition
ZCS	zero-current-switching
EMI	electromagnetic interference
SIDO	single-inductor dual-output
DISO	dual input-single output
MIMO	multi input-multi output
SISOC	single-input single-output converter
DOC	dual-output converter
DIC	dual-input converter
MI	multi input

SQP	sequential quadratic programming
CCM	continuous conduction mode
GPIO	general-purpose I/Os
LSIRC	low-speed internal RC
LSE	low-speed external
DMA	direct memory access
ADC	analog to digital conversion
USART	universal synchronous asynchronous receiver transmitter