SKEE 3742

SEKOLAH KEJURUTERAAN ELEKTRIK
FAKULTI KEJURUTERAAN

UNIVERSITI TEKNOLOGI MALAYSIA

POWER ELECTRONICS LABORATORY
STUDENT PACK
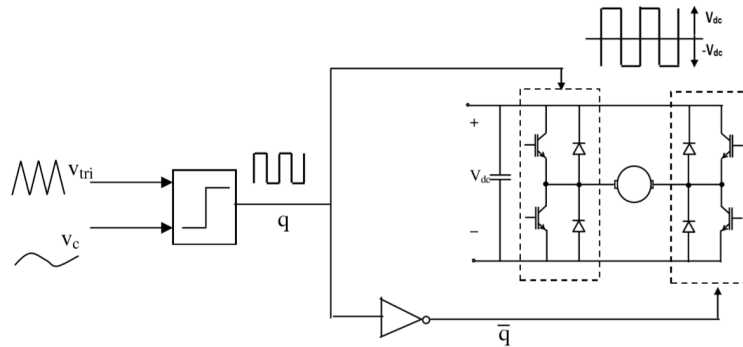
4-quadrant DC Motor Drive

Disediakan oleh:	Disahkan oleh:
PM. Dr. Nik Rumzi Nik Idris	Pengarah Program
PM. Dr. Naziha Ahmad Azli	Dr. Jasrul Jamani Jamian
PM. Dr. Awang Jusoh	
PM. Dr. Junaidi Abdul Aziz	
PM. Dr. Shahrin Md. Ayob	
PM. Ir. Dr. Tan Chee Wei	Tandatangan
Dr. Mohd. Rodhi Sahid	Cop
Dr. Norjulia Mohammad Nordin	:
En. Nik Din Muhammad	
En. Zaki Daud	
Tarikh : 18 Julai 2019	Tarikh : 18 Julai 2019

1	**Problem/Project Guide:**
	A 4-quadrant DC-DC converter is used to control the DC motor drives that require forward and reverse motoring as well as forward and reverse braking. The four quadrant converter for DC motor drive which we will study in this lab consists of four power switches (IGBTs with anti-parallel diodes). Figure 1 shows the topology and control of this converter when it is used to fed a DC motor. Your task is to simulate the 4-quadrant converter and its control using SIMULINK and to show that the converter is indeed capable of operating in all quadrants of operation. You are then required to implement this 4-quadrant converter using the equipment modules available in the lab. The SIMULINK model of the DC motor will be provided to you during the lab session. You should also compare and discuss on the waveforms obtained from the simulation and experiment. (a) Problem-solving Time-line

	Activities	Week 1	Week 2	Week 3
1.	Understand the given problem. Identify what you already know and what you need to know. Brainstorming for ideas. Identify the tools that will be used.	√		
2.	Present ideas to facilitator. Start working on solution and simulation design Run the simulation to obtain results.		√	
3.	Set-up hardware and run experiment. Validate the simulation result.			√

(b) Your report for this laboratory must include:
- Discussion on the basic operation of 4-quadrant converter,
- SIMULINK model and simulation results of the 4-q converter,
- experimental results from oscilloscope,
- Discussions on all the simulation and experimental results

2	**Equipments list:**
	1. DC motor: R_a = 8Ω, L_a = 3.9mH, Back EMF constant = 0.0518 V/rad-1 2. DC generator to be used as a tacho generator (speed sensor)

	3. DC power supply (input DC voltage for the converter): set to 30V
	4. Modules from the bench:
	a) 4 IGBT switches to construct the 4-quadrant DC-DC converter(735342)
	b) PWM generator (735341)
	c) Voltmeter
	d) Ammeter
	e) Potentiometer (73402)
	f) Oscilloscope
	Please ensure that your circuit is checked by the lab supervisor/facilitator before running the experiment.
3	**Components list:**
	none
4	**Software:**
	- Matlab/SIMULINK simulation package (installed on PCs in the Power Electronics Lab) - SIMULINK model of the DC motor will be provided to you during the laboratory session.
5	**Additional resources:**
	You are expected to have the basic knowledge in power electronic DC-DC converter.
6	**References**
	"Power Electronics: Converters, Applications, and Design - 3rd Ed.", Ned Mohan, Wiley, 2002. (Chapter 7, Section 7.7, "FULL-BRIDGE dc-dc CONVERTER")