

**THE DESIGN OF WIRELESS POWER TRANSFER
TECHNOLOGY FOR AUTONOMOUS ELECTRICAL VEHICLES
USING CLASS E INVERTER CIRCUIT: AN INDUCTIVE
APPROACH**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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TECHNOLOGY FOR AUTONOMOUS ELECTRICAL
VEHICLES USING CLASS E INVERTER CIRCUIT: AN
INDUCTIVE APPROACH**

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DECLARATION

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APPROVAL

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DEDICATION

Appreciate My Father and Mother

ABSTRACT

Electrical autonomous vehicle had been a trend in nowadays. However, transportable distance was one of the main concerns for the system. Although battery technologies had become more advanced, the distance covered by electrical vehicles were still be limited. In this project, a wireless power transfer technology using an inductive approach to power up the vehicle while moving had been proposed. Generally, this ‘on the go’ wireless charging or dynamic charging, had been archived by embedded the transmitter coil underneath the road and a receiver coil had placed at the vehicle i.e. car. A Class E Inverter had been designed with operating frequency 1 MHz to ensure the power loss was minimal in the IPT System. Furthermore, a LCCL Impedance Matching technique had been proposed to maintain the output power while a drastic change in alignment happens in the power transmission. At the end of the project, a prototype had been developed with a Line Follower Car which powered without battery. The efficiency of this system was 28.73 % with an output power of 3.1022 W.

ABSTRAK

Kenderaan autonomi elektrik telah menjadi trend pada masa kini. Walau bagaimanapun, jarak adalah salah satu faktor utama bagi sistem ini. Walaupun teknologi bateri telah meningkatkan, jarak yang diliputi oleh kenderaan elektrik masih terhad. Oleh itu, teknologi “pemindahan kuasa tanpa wire” dengan cara “induktif” telah diguna untuk menguatkan kenderaan semasa bergerak. Umumnya, teknologi “on the go” atau “dynamic charging” ini akan memasang gegelung pemancar di bawah jalan dan gegelung penerima akan diletakkan pada kenderaan. “Class E Inverter” telah direka dengan kekerapan operasi 1 MHz untuk memastikan kehilangan kuasa adalah minimum dalam Sistem “IPT”. Selain itu, teknik “Impedance Matching” telah mencadangkan untuk mengekalkan kuasa output sementara perubahan drastik dalam penjajaran berlaku dalam penghantaran kuasa. Pada akhir projek, prototaip telah dibangunkan dengan Kereta Pengikut Baris yang berkuasa tanpa bateri. Kecekapan sistem ini adalah 28.73% dengan kuasa output 3.1022 W.

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TABLE OF CONTENTS

Declaration	
Approval	i
Dedication	i
Abstract	i
Abstrak	ii
Acknowledgements	iii
Table of Contents	iv
List of Figures	x
List of Tables	xv
List of Symbols and Abbreviations	xvi
CHAPTER 1 INTRODUCTION	1
1.1 Project Background	1
1.2 Project Objective	3
1.3 Problem Statement	3

1.4	Scope of Project	4
CHAPTER 2 BACKGROUND STUDY		6
2.1	Wireless Power Transfer (WPT)	6
2.1.1	Far Field	9
2.1.2	Near Field	9
2.1.2.1	Capacitive Power Transfer (CPT)	10
2.1.2.2	Inductive Power Transfer (IPT)	11
2.2	Class E Zero Voltage Switching Inverter	13
2.2.1	Working Principle	14
2.2.2	Zero Voltage Switching (ZVS)	15
2.2.3	Class E Component Function	16
2.2.3.1	LC Resonant Tank	16
2.2.3.2	Choke Inductor	16
2.2.3.3	Shunt Capacitor	16
2.2.3.4	Switching Transistor	16
2.2.4	Class E Fine Tuning	17
2.3	Impedance Matching	17
2.3.1	Series-Series Configuration	18
2.3.2	Series-Parallel Configuration	18
2.3.3	Suggestion on topology	19

CHAPTER 3 METHODOLOGY	20
3.1 Project Methodology	21
3.1.1 First Phase of the Work	22
3.1.2 Second Phase of the Work	23
3.1.3 Third Phase of the Work	24
3.1.4 Prototyping	25
3.2 Class E DC-AC Inverter	26
3.2.1 Calculation	26
3.2.2 Simulation	30
3.2.2.1 Construct Circuit	30
3.2.2.2 Config Signal Source	31
3.2.2.3 Config Simulation Parameter	33
3.2.3 Experiment & Construct	34
3.2.3.1 Schematic	34
3.2.3.2 Material and Apparatus	35
3.3 Inductive Power Transfer (IPT) System	40
3.3.1 Transformer Simulation	40
3.3.2 Design of Transmitter & Receiver Coil	42
3.3.2.1 Calculation of Inductance	42
3.3.2.2 Type of wire used to design Coil	42

3.4	Impedance Matching	43
3.4.1	LCCL Impedance Matching	43
3.5	Prototype Design	44
3.5.1	Line Following Car	44
3.5.1.1	Logic	44
3.5.1.2	Connection and Schematic	44
3.5.2	Transmitter Track	45
3.5.3	Printed Circuit Board (PCB)	46
3.5.4	Fine Tuning	47
3.6	Power Efficiency	47
CHAPTER 4 RESULTS AND DISCUSSION		48
4.1	Project Progression	49
4.1.1	First Phase	49
4.1.2	Second Phase	49
4.1.3	Third Phase	49
4.1.4	Prototyping	49
4.2	Class E DC-AC Inverter	50
4.2.1	Calculation	50
4.2.2	Simulation	51
4.2.2.1	Constructed Circuit	51

4.2.2.2	Analysis of Circuit	52
4.2.3	Experiment & Construct	53
4.2.4	Overall Parameters	56
4.3	Inductive Power Transfer (IPT) System	57
4.3.1	Transformer Simulation	57
4.3.2	Design of Transmitter & Receiver Coil	59
4.4	Impedance Matching	61
4.4.1	LCCL Impedance Matching	61
4.4.1.1	Simulation Result	61
4.4.1.2	Effect in Implementation	63
4.5	Prototype	65
4.5.1	Line Follower Car	65
4.5.1.1	Logic Implementation	65
4.5.1.2	Assemble	69
4.5.2	Transmitter Track	70
4.5.3	Printed Circuit Board (PCB)	71
4.5.4	Fine Tuning	72
4.5.4.1	Simulation	72
4.5.4.2	Experiment & Construct	74
4.6	Power Efficiency	77

4.6.1 Without Load	77
4.6.2 With Load	78
CHAPTER 5 CONCLUSION AND FUTURE WORKS	81
5.1 Future work	82
REFERENCES	83

LIST OF FIGURES

Figure 1.1 Runway Layout	4
Figure 1.2 Prototype Block Diagram	5
Figure 2.1 WPT Block Diagram	7
Figure 2.2 Map of Wireless Power Transfer (WPT)	9
Figure 2.3 Capacitive Power Transfer (CPT) system	10
Figure 2.4 Inductive Power Transfer (IPT) System	11
Figure 2.5 Loosely Coupled Transformer	12
Figure 2.6 Class E Inverter Schematic	13
Figure 2.7 Turn on State	14
Figure 2.8 Turn off State	14
Figure 2.9 ZVS vs Square Wave	15
Figure 2.10 ZVS vs Square Wave	15
Figure 2.11 Effect of Component Change[28]	17
Figure 2.12 Series-Series Configuration	18
Figure 2.13 Series-Parallel Configuration	18
Figure 3.1 Overall Flow Chart of Project	21

Figure 3.2 The First Phase of the Work	22
Figure 3.3 The Second Phase of the Work	23
Figure 3.4 The Third Phase of the Work	24
Figure 3.5 The Prototyping Phase	25
Figure 3.6 LTspice XVII User Interface	30
Figure 3.7 LTspice New Schematic	30
Figure 3.8 LTspice Component Select Menu	31
Figure 3.9 LTspice Signal Component	31
Figure 3.10 LTspice Signal Configuration	32
Figure 3.11 LTspice Simulation Configuration	33
Figure 3.12 Schematic of Class E Inverter	34
Figure 3.13 IRFP250N	35
Figure 3.14 TC4422 by Microchip	36
Figure 3.15 Typical Schematic of TC4422	36
Figure 3.16 50W Resistor	37
Figure 3.17 Radial-Lead Inductor	38
Figure 3.18 Inductor in parallel	38
Figure 3.19 polypropylene film capacitor	39
Figure 3.20 NP0 SMD Multilayer Ceramic Capacitor	39
Figure 3.21 Class E Inverter Circuit for IPT implementation	40
Figure 3.22 LTspice Transformer Model	40
Figure 3.23 LTspice Toolbar	41
Figure 3.24 LTspice SPICE directive	41

Figure 3.25 Skin Effect Diagram	42
Figure 3.26 LCCL Impedance Matching with Series Configuration	43
Figure 3.27 LCCL Impedance Matching with Parallel Configuration	43
Figure 3.28 Sensor and Motor Connection	44
Figure 3.29 Line Following Track	45
Figure 3.30 Line Following Transmitter	45
Figure 3.31 Schematic on Protues	46
Figure 3.32 PCB Trace	46
Figure 3.33 PCB Trace on a Transparency	46
Figure 4.1 Simulation Circuit	51
Figure 4.2 Simulation ZVS Waveform	52
Figure 4.3 Input Power of Class E Simulation	52
Figure 4.4 Output Power of Class E Simulation	52
Figure 4.5 Circuit of Class E Inverter	53
Figure 4.6 ZVS Waveform of Class E Inverter	54
Figure 4.7 Current of Class E Inverter	54
Figure 4.8 Measurement of Load Resistor, R_{Load}	55
Figure 4.9 Output of Class E Inverter	55
Figure 4.10 Simulation of IPT System	57
Figure 4.11 Actual Size of Transmission System	57
Figure 4.12 ZVS of IPT System Simulation	58
Figure 4.13 Input Power of the IPT System Simulation	58
Figure 4.14 Output Power of the IPT System Simulation	58

Figure 4.15 Transmitter Coil	59
Figure 4.16 Measurement of Transmitter Coil	59
Figure 4.17 Receiver Coil & Circuit	60
Figure 4.18 Simulation Result of IPT System with LCCL Impedance Matching	61
Figure 4.19 ZVS of IPT System with LCCL Impedance Matching	62
Figure 4.20 Input Power of the IPT System with LCCL Impedance Matching	62
Figure 4.21 Output Power of the IPT System with LCCL Impedance Matching	62
Figure 4.22 Graph of Output Power against Coupling Factor	64
Figure 4.23 Graph of Efficiency against Coupling Factor	64
Figure 4.24 Code Pin Initialization	65
Figure 4.25 Code Setup	66
Figure 4.26 Code Read Sensor Loop	66
Figure 4.27 Code Line Follower Logic	67
Figure 4.28 Code Forward Function	68
Figure 4.29 Code Backward Function	68
Figure 4.30 Code Right Function	68
Figure 4.31 Code Left Function	68
Figure 4.32 Code Stop Function	68
Figure 4.33 Top View of Line Follower Car	69
Figure 4.34 Bottom View of Line Follower Car	69
Figure 4.35 Side View of Line Follower Car	69
Figure 4.36 Top View of Track	70
Figure 4.37 Bottom View of Track	70

Figure 4.38 PCB Trace with SMD soldered	71
Figure 4.39 PCB Top view	71
Figure 4.40 Simulation Result of IPT System for Fine Tuning	72
Figure 4.41 Input Power of the IPT System for Fine Tuning	73
Figure 4.42 Output Power of the IPT System for Fine Tuning	73
Figure 4.43 ZVS of IPT System for Fine Tuning	73
Figure 4.44 Inductance of Transmitter Coil Before Tuning	74
Figure 4.45 Inductance of Transmitter Coil After Tuning	74
Figure 4.46 ZVS Waveform of Class E Inverter After Fine Tuning	75
Figure 4.47 Current of Class E Inverter After Fine Tuning	75
Figure 4.48 Measurement of Load Resistor, R_{Load}	76
Figure 4.49 Output of Class E Inverter After Fine Tuning	76
Figure 4.50 Supply Voltage of no-load Class E Inverter	77
Figure 4.51 Supply Current of no-load Class E Inverter	77
Figure 4.52 ZVS Waveform of no-load Class E Inverter	78
Figure 4.53 Supply Current of Load Class E Inverter	78
Figure 4.54 ZVS Waveform of Load Class E Inverter	79
Figure 4.55 Load on the Track	79
Figure 4.56 Load Voltage	80
Figure 4.57 Load Current	80

LIST OF TABLES

Table 3.1 Preset Parameter.....	26
Table 3.2 Bill of Material (BOM)	34
Table 3.3 Line Following Logic.....	44
Table 4.1 Calculation Result	50
Table 4.2 Class E Parameter Comparison.....	56
Table 4.3 Comparison Before, After applied Impedance Matching	63
Table 4.4 Effect of Impedance Matching Circuit.....	63

LIST OF SYMBOLS AND ABBREVIATIONS

WPT	:	Wireless Power Transfer
IPT	:	Inductive Power Transfer
CPT	:	Capacitive Power Transfer
ZVS	:	Zero Voltage Switching
DC	:	Direct Current
AC	:	Alternating Current

CHAPTER 1

INTRODUCTION

This chapter will briefly introduce the concept of wireless power transmission (WPT) for electrical autonomous vehicles. The project background, project objectives, problem statement of the project, scope of work and the structure of report will also be involved.

1.1 Project Background

Electrical autonomous vehicles will be in demand in the future [1]. This is due to the battery technologies had become more advanced in term of capacity and cost. Since the electrical vehicles is driven by battery, so the charging process is unpreventable

In order to, backing the usage of electrical vehicles, the infrastructure of charging station must be ready to the society. Due to the huge capacity of the battery, the

changing period will be significant. People will need to wait minimum as 30 minute or maximum will be reach 12 hours for doing nothing. The waiting time will be a waste to the society. Even though, the car was fully charge, the distance travel is still be limited. Let's consider a circumstance, the electrical vehicle was running out of battery before it reaches any charging station. We can't guaranty this situation won't happen in real life. Although battery technologies become so advanced to realize the electric driven vehicle, the distance covered is still insufficient. The motive of this project is to propose wireless power transfer technologies using an inductive approach to power up the vehicle while moving. This 'on the go' wireless charging is also known as dynamic charging. Generally, in this work, the transmitter coil will be embedded underneath the road meanwhile the receiver coil will be placed at the vehicle i.e. car. A Class E inverter circuit will be designed at transmitter part to ensure the power loss is minimal as the operating frequency proposed here is 1 MHz. Furthermore, an impedance matching circuit will be also proposed to maintain the output power if some change happens in the load impedance. At the end of the project, a prototype is expected to be developed that can power up the mini autonomous car at the efficiency of at least 80%.