CONTROL OF POWER ELECTRONICS CIRCUITS FOR HYDROGEN GENERATION SYSTEM USING SOLAR POWER

THESIS

ELECTRICAL ENGINEERING
CONCENTRATION ELECTRICAL POWER SYSTEM

Declared qualified to obtain
a Master degree in Engineering

MUHAMMAD AFNAN HABIBI

NIM. 156060312111003

BRAWIJAYA UNIVERSITY

FACULTY OF ENGINEERING

M A L A N G

2017

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date of the exam : August 30th, 2017
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Supervisors Team,

Supervisor I	Supervisor II
Ir. Wijono, M.T., Ph.D.	**Dr. Rini Nur Hasanah, S.T., M.Sc.**

Malang, 21 NOV 2017

Brawijaya University
Faculty of Engineering, Electrical Engineering
Head of Electrical Engineering Postgraduate Program

Dr.Eng. Panca Mudjirahardjo, S.T., M.T.
NIP 197003292000121001

IDENTITY OF THESIS EXAMINER TEAM

THESIS TITLE:
CONTROL OF POWER ELECTRONICS CIRCUITS FOR HYDROGEN GENERATION SYSTEM USING SOLAR POWER

Student's Name	: Muhammad Afnan Habibi
Student's ID Number	: 156060312111003
Study Program	: Electrical Engineering
Consentration	: Electrical Power System

SUPERVISOR'S TEAM

Supervisor I	: Ir. Wijono, M.T., Ph.D.
Supervisor II	: Dr. Rini Nur Hasanah, S.T., M.Sc.

EXAMINER'S TEAM

Examiner I	: Prof. Ichijo Hodaka
Examiner II	: Prof. Koichi Tanno
Examiner III	: Prof. Hiroki Tamura
Examination Date	: August 30, 2017
Decree Letter of Examiner	:

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I declare that, to the best of my knowledge, this Thesis does not contain scientific article published by other person to gain academic degree in a University or higher institution, as well as ideas or opinions that have been written or published by other person, except the ones written as quotations in this Thesis and mentioned in the sources/Thesis References.

If it is proven that this Thesis contains traces of PLAGIARISM, I thereby agree that this Thesis is rejected and my academic title (MAGISTER) that I have obtained is cancelled and processed according to the existing regulations (UU No. 20 Tahun 2003, Pasal 25 ayat 2 dan Pasal 70)

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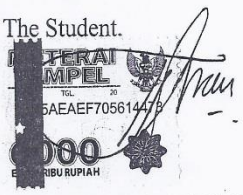
The Student.



Name : **MUHAMMAD AFNAN HABIBI**

NIM : **156060312111003**

PM : **ELECTRICAL ENGINEERING**

CURRICULUM VITAE

The author's name is Muhammad Afnan Habibi. He was born in Surabaya, November 26, 1991. He had been living in Waru, Sidoarjo, Jawa Timur, Indonesia. In 1998-2004, the first formal education he took was Hang Tuah X Elementary School. In 2004-2007, the second formal education he took was Junior High School 3. In 2007-2010, the third formal education he took was Senior High School 4. All the primary schools was in Sidoarjo. He began to study in Electrical Engineering, Faculty of Engineering, Brawijaya University in 2010 and graduated in 2015. In the same year, he continued his study in Double Degree Program provided by Brawijaya University and University of Miyazaki. He spent one year for each university. He is going to finish the Double Degree Program in 2017.

Miyazaki, August 30, 2017

Author

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Miyazaki, August 30, 2017

Author

PREFACE

In the name of *Allah Subhanahu wa ta'ala*, The Most Beneficent and The Most Merciful. Peace be upon *Muhammad Shallallahu 'alaihi wasallam*. There are no power and strength except from The God. Finally, the thesis book "Control of Power Electronics Circuits for Hydrogen Generation System Using Solar Power" is finished. At last, I hope this book gives merits especially engineering students. In general, this book gives benefits for all community.

Miyazaki, August 30, 2017
Author

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Wireless Power Transfer (WPT)

Electromagnetic (EM)

Proton Exchange Membrane (PEM)

Photovoltaic (PV)

RINGKASAN

Muhammad Afnan Habibi, Teknik Elektro, Fakultas Teknik, Universitas Brawijaya, Agustus 2017, *Control of Power Electronics Circuits for Hydrogen Generation System using Solar Power*, Dosen Pembimbing: Wijono dan Rini Nur Hasanah

Manusia membuat mesin-mesin untuk membantu mereka di banyak bidang. Mesin-mesin mengubah sebuah energi menjadi energi lain yang berguna dalam pekerjaan. Mereka membuat mesin-mesin bakar. Motor bakar meninggalkan panas dan polusi sebagai limbahnya. Motor tersebut mengkonsumsi energi dari bahan bakar fosil yang dapat habis di kemudian hari.

Para peneliti telah melakukan pembelajaran untuk menggunakan jenis-jenis energi lain yang bersih, aman, dan tersedia di hari esok. Mereka mempelajari tentang energi listrik yang mempunyai kemampuan berubah dari atau menjadi energi ke bentuk yang lain, seperti gerak, panas, cahaya, tekanan, dan lain-lain. Salah satu tema riset yang hangat adalah *solar-hydrogen generator* yang sangat berguna untuk suplai listrik.

Penelitian ini memberikan metode pengiriman daya listrik melalui medan *electro magnetic* disebut dengan *wireless power transfer*. Metode ini sangat berguna untuk mengontrol rangkaian dari proses pembuatan hidrogen. Karena hydrogen mungkin dapat meledak, maka lebih baik untuk memisah antara pembangkit listrik dengan pembangkit hidrogen. Keuntungan lain adalah pembangkit hidrogen dapat beroperasi di dalam ruang, saat *solar cell* menghasilkan listrik di luar.

Setelah melakukan banyak simulasi, parameter lilitan diperoleh. Frekuensi resonansi juga dapat ditentukan dimana sistem *wireless* mengirim daya keluar yang tinggi. Daya masuk dari *solar cell* cukup untuk membangkitkan hidrogen dalam jumlah kecil selama tersedia sinar matahari.

Kata kunci: *hydrogen generator*, *wireless power transfer*, *resonance frequency*, *electromagnetic waves*

SUMMARY

Muhammad Afnan Habibi, Electrical Engineering, Faculty of Engineering, University of Brawijaya, August 2017, *Control of Power Electronics Circuits for Hydrogen Generation System using Solar Power*, Academic Supervisor: Wijono and Rini Nur Hasanah

Human built machines for helping them in many fields. Machines converts an amount of energy into other energy which usable for human works. They built the fuel combustion machines. Motor fuel leaves heat and pollution as its waste. It also consumes fuel energy from fossil fuel which might be exhausted some day.

Researchers has been studying for using other kinds of energy which clean, safe, available in future. They learned about electrical energy which has flexibility conversion from or into some kinds of other energy, like motion, heat, light, pressure, etc. One of popular research field is Solar-hydrogen generator which is very useful to supply electricity.

This research provides the methods sending electric power via EM field known as WPT (WPT). WPT is very useful for controlling circuit of hydrogen production process. Since hydrogen might be exploded, it is better to separate electricity generation and hydrogen generation. Another benefit is hydrogen generation operates inside house, while solar cell produces electricity outside.

After doing many simulations, coils parameters can be obtained. Resonance frequency can also be decided at where WPT produce high power output. Power input from solar cell should be enough as long as there is sun light at any moment. Power output should be adequate to generate small amount of hydrogen.

Keywords: hydrogen generator, wireless power transfer, resonance frequency, electromagnetic waves