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製造與管理外國學生專班 102 秋季班

碩士論文

永磁式同步發電機之風力發電系統模擬

**Modeling and Simulation of an Autonomous  
Control PMSG Wind Turbine**

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中華民國 103 年 12 月

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**A Thesis  
Submitted to Institute of Industrial Engineering and Management  
National Kaohsiung University of Applied Sciences  
in Partial Fulfillment of the Requirements  
for the Degree of  
Master of Engineering  
In  
Industrial Engineering and Management**

**December 2014**

**Kaohsiung, Taiwan, Republic of China**

中華民國 103 年 12

## Acknowledgement

I would first express my utmost gratitude to my advisor, Professor Chia-Nan Wang who has always been there with me throughout when I needed assistants. Professor Wang's guidance, words of advice, motivation as well as reassurance come at the most critical of times and helped me through. The vast knowledge and assertiveness of my supervisor will always be valuable for me. Also, I would like to appreciate Professor Wang's patience with me, even in times when I made mistakes which never shied away from or tired from correcting.

Secondly, special thanks to all my colleagues and lab mates for their words of encouragement and providing a helping hand. Their friendship through this period was very important. No man is an island, and their friendship as well as assistance helped me get through. I would not have done it without them, or reach the height I obtained my work.

Words alone cannot describe my deepest affection and appreciation to my family. My family's love together with encouragement and sacrifice allowed me to go abroad for further studies. Everything I have achieved has highly been assisted by my family. Without them, this work would have been a heavy burden for me to bear. Their constant reassurance and persistence enabled me to focus on my research paper.

Le Xuan Khoa

December 11<sup>st</sup> 2014

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### **Abstract**

Natural resources such as oil, gases and coal are running out in these days. There would be an urgent need of the alternative power resources, and wind power is one of the principal solutions. Currently, an enormous amount of research related to wind turbines has been conducted. While various control strategies have been studied in many projects to improve the efficiency of wind turbines, these control strategies are often conducted separately. Therefore, with the sake of combining distinct control strategies together, this research has been processed. There are two main parts of this research. The first aim is to model a wind turbine driven permanent magnetic synchronous generator (PMSG) which feeds alternating current (AC) power to the utility grid. The second aim is to study the effects and the efficiency of the PMSG wind turbine which is integrated by autonomous controllers. Overall, in order to be well autonomous control, two voltage source inverters are used to control wind turbine connecting with the grid. Firstly, the generator-side inverter is used to adjust the synchronous generator as well as separate the generator from the grid when it is necessary. Secondly, the grid-side inverter is used to control the power flow between the DC bus and the AC side, and both of them are oriented control by pulse width modulation (PWM). In addition, the proportional-integral (PI) controller is enhanced to control in both inverters and the pitch angle of the wind turbine. Maximum power point tracking (MPPT) is integrated in generator-side inverter to track the maximum power when wind speed changes. The simulation results in Matlab Simulink 2012b showing the model have good dynamic and static performance. The maximum power can be tracked and the generator wind turbine can be operated in high efficiency. Thus, this research can reveal that the combination of separate control strategies tends to work well, with the accompaniment of modeling analysis.

Keywords: PMSG Wind Turbine; Generator-side Inverter, Grid-side Inverter; Pitch Angle Controller.

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