

การสร้างและออกแบบตัวควบคุมของเพนดูลัมผกผันเคลื่อนที่



นายลีเชค เกา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
สาขาวิชาวิศวกรรมไฟฟ้า ภาควิชาวิศวกรรมไฟฟ้า
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2549
ISBN 974-14-2037-4
ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

**IMPLEMENTATION AND CONTROLLER DESIGN OF A MOBILE INVERTED
PENDULUM**

Mr. Lychek Keo

**A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering Program in Electrical Engineering
Department of Electrical Engineering
Faculty of Engineering
Chulalongkorn University
Academic Year 2006
ISBN 974-14-2037-4**

490279

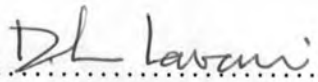
Thesis Title IMPLEMENTATION AND CONTROLLER DESIGN OF A MO-
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By Mr. Lychek Keo

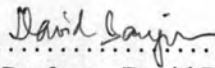
Field of Study Electrical Engineering

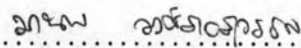
Thesis Advisor Assistant Professor Manop Wongsaisuwan, D. Eng.

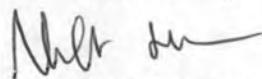
Accepted by the Faculty of Engineering, Chulalongkorn University in Partial
Fulfillment of Requirements for Master's Degree


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ลิขิต เกา: การสร้างและออกแบบตัวควบคุมของเพนดูลัมผกผันเคลื่อนที่ (IMPLEMENTATION AND CONTROLLER DESIGN OF A MOBILE INVERTED PENDULUM), อ. ที่ปรึกษา: ผศ.ดร. มานพ วงศ์สายสุวรรณ, 131 หน้า, ISBN 974-14-2037-4

ในวิทยานิพนธ์ฉบับนี้ เราหาสมการพลวัตไม่เชิงเส้น ของเพนดูลัมผกผันเคลื่อนที่ บนพื้นฐานของแบบจำลองของเพนดูลัมผกผัน จากนั้นสมการไม่เชิงเส้นถูกแปลงให้เป็นเชิงเส้นเพื่อให้ได้แบบจำลองเชิงเส้นซึ่งใช้ในการออกแบบตัวควบคุม เป้าหมายของเราคือการออกแบบตัวควบคุมสองชนิด ได้แก่ตัวควบคุมไม่เชิงเส้นและตัวควบคุมป้อนกลับสถานะ ตัวควบคุมทั้งสองนี้สามารถรักษาจุดของเพนดูลัมผกผันเคลื่อนที่ โดยประกันเสถียรภาพ สมรรถนะ และความคงทนของระบบไม่เชิงเส้นที่ต้องการควบคุมได้ตามต้องการ ตัวควบคุมชนิดแรกคือตัวควบคุมกำหนดอัตราขยาย ซึ่งอยู่บนพื้นฐานของเทคนิคการสังเคราะห์เชิงเส้นที่เปลี่ยนตามพารามิเตอร์ และวิธีการแปลงเศษส่วนเชิงเส้น เรานำตัวควบคุมนี้ไปทำให้เป็นผลบน MATLAB และต่อเข้ากับหุ่นทางช่องทาง RS232 สำหรับตัวควบคุมชนิดที่สองคือตัวควบคุมป้อนกลับสถานะ ซึ่งออกแบบโดยวิธีคุมค่าเชิงเส้นกำลังสอง และวิธีวางตำแหน่งขั้ว ตัวควบคุมชนิดนี้สามารถรักษาจุดของเพนดูลัมผกผันเคลื่อนที่รอบๆจุดสมดุลได้ และถูกทำให้เป็นผลบน DSPIC ซึ่งทำให้หุ่นสามารถรักษาจุดได้ด้วยตัวของมันเอง ท้ายที่สุดเราได้สร้างเพนดูลัมผกผันเคลื่อนที่ซึ่งสามารถเคลื่อนที่ไปข้างหน้า ข้างหลัง ข้างซ้าย และข้างขวา โดยใช้การควบคุมระยะไกล

ภาควิชา วิศวกรรมไฟฟ้า
สาขาวิชา วิศวกรรมไฟฟ้า
ปีการศึกษา 2549

ลายมือชื่อนิสิต
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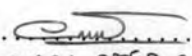
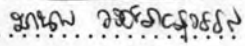
##4770686821: MAJOR ELECTRICAL ENGINEERING

KEY WORD: A MOBILE INVERTED PENDULUM / BALANCING ROBOT / STATE FEEDBACK / STATE SPACE CONTROL / LQR / POLE PLACEMENT / LPV / GAIN SCHEDULING / MODELING / NONLINEAR SYSTEM / KALMAN FILTER

LYCHEK KEO: IMPLEMENTATION AND CONTROLLER DESIGN OF A MOBILE INVERTED PENDULUM, THESIS ADVISOR: MANOP WONGSAISUWAN, D. Eng., 131 pp., ISBN 974-14-2037-4

In this thesis we find nonlinear dynamic equations of a Mobile Inverted Pendulum (MIP) based on the inverted pendulum model. Then we linearize the nonlinear equations to obtain the linear model which was used in the controller design. Our goal is to design two controllers, the first one is a nonlinear controller and the second one is a state feedback controller. These controllers have ability for balancing an MIP that can guarantee stability, performance and robustness for the nonlinear plant. The first controller is gain scheduling controller which is based on Linear Parameter-Varying (LPV) synthesis techniques and Linear Fractional Transformation (LFT) approaches. This controller is implemented on MATLAB and connected to the robot via RS232 port. The second controller is a linear state-feedback LQR and Pole-placement controller. It is proposed to balance the MIP around equilibrium point and it is implemented on a DSPIC so that the robot can balance itself autonomously. Finally, we construct an MIP that could move forward, backward, leftward or rightward via a remote control.

Department Electrical Engineering
 Field of study Electrical Engineering
 Academic year 2006

Student's signature 
 Advisor's signature 

Acknowledgments

Most of all, I am grateful to my principal advisor, Asst. Prof. Manop Wongsaisuwan for his help and encouragement in every technical and academic problem I faced over the past two years. He always made his time available to discuss my research working with him has been exhilarating experience. I feel lucky to have had my path cross him.

I would like to thank Assoc. Prof. David Banjerdpongchai and Dr. Naebboon Hoonchareon for being on a committee of my oral exam. Their inputs, helpful suggestions, and comments on the proposal exam are invaluable for the following steps of my research.

I would also like to thank Khett Pitoonmanit for several helpful discussions on LPV controller design and Boat, Pink, Pi Sun, Pi Aid , Pi Tea, Pi Dach, Ed and Tu Anh for their friendship and hospitality.

Finally, special credit goes to my family: my parents, and my wife, Rasmey for their support throughout the production of this dissertation and encouragement for my study in Thailand.

This research was carried out at CSRL, the Control System Research Laboratory at Chulalongkorn University and was fully funded through AUN/SEED-Net scholarship, which is gratefully acknowledged.

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