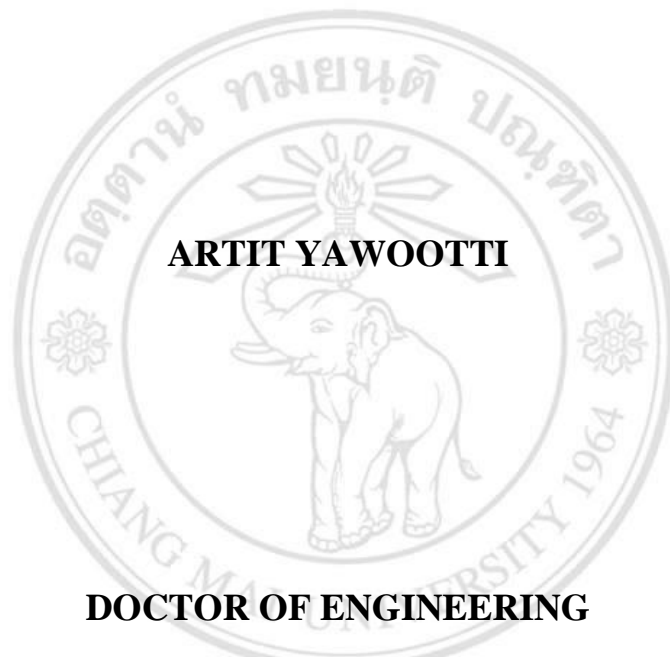


**DEVELOPMENT OF A MULTI CHANNEL
AIRBORNE PARTICULATE MATTER
DETECTOR BY ELECTRICAL
TECHNIQUE**



ARTIT YAWOOTTI

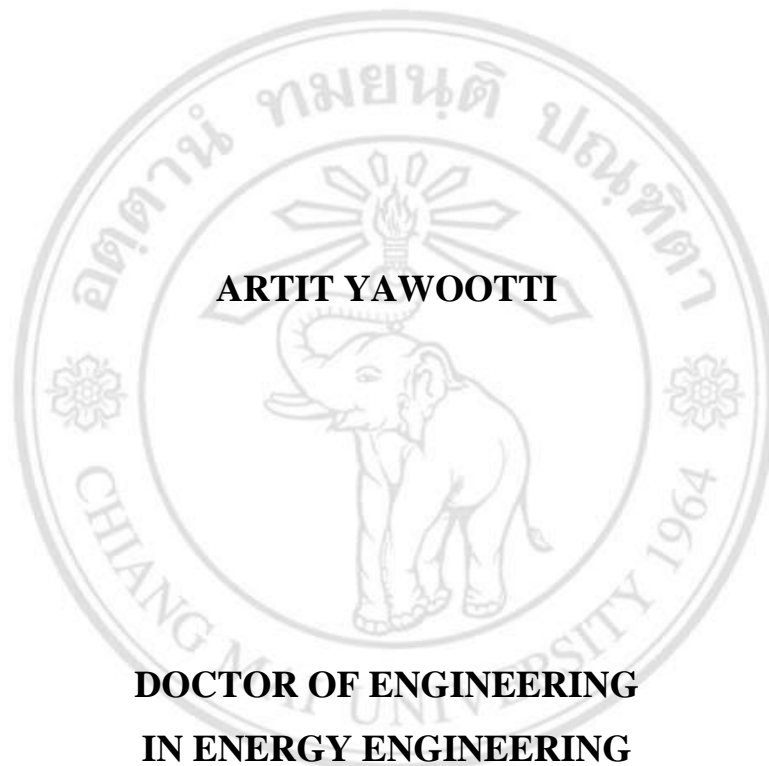
**DOCTOR OF ENGINEERING
IN ENERGY ENGINEERING**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

**GRADUATE SCHOOL
CHIANG MAI UNIVERSITY**

APRIL 2017

**DEVELOPMENT OF A MULTI CHANNEL AIRBORNE
PARTICULATE MATTER DETECTOR
BY ELECTRICAL TECHNIQUE**



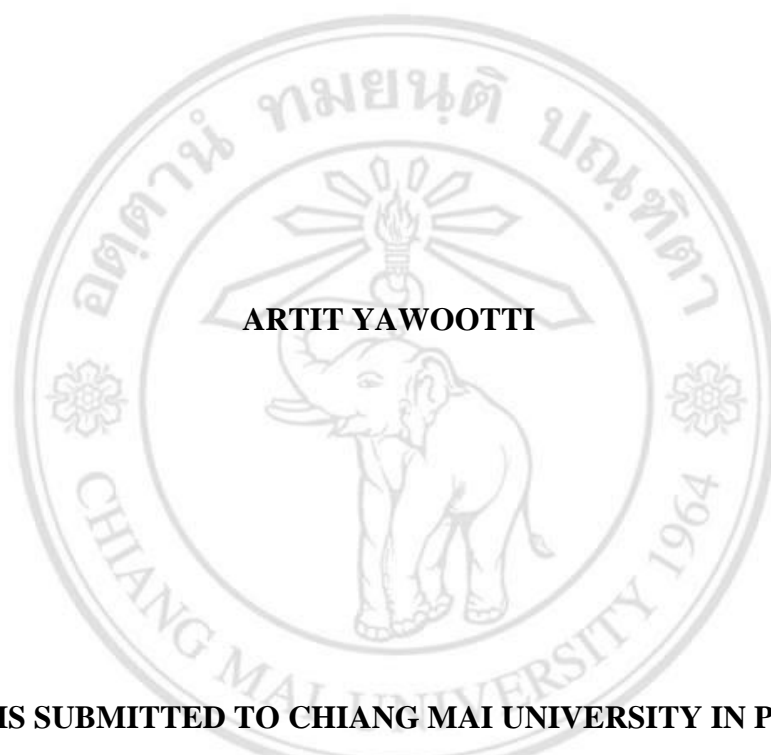
**DOCTOR OF ENGINEERING
IN ENERGY ENGINEERING**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

**GRADUATE SCHOOL
CHIANG MAI UNIVERSITY**

APRIL 2017

**DEVELOPMENT OF A MULTI CHANNEL AIRBORNE
PARTICULATE MATTER DETECTOR
BY ELECTRICAL TECHNIQUE**



ARTIT YAWOOTTI

**A THESIS SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF ENGINEERING
IN ENERGY ENGINEERING**

GRADUATE SCHOOL, CHIANG MAI UNIVERSITY


APRIL 2017

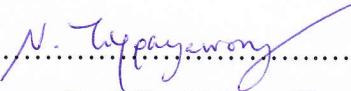
**DEVELOPMENT OF A MULTI CHANNEL AIRBORNE
PARTICULATE MATTER DETECTOR
BY ELECTRICAL TECHNIQUE**

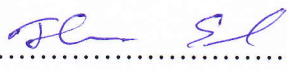
ARTIT YAWOOTTI


THIS THESIS HAS BEEN APPROVED TO BE A PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF ENGINEERING
IN ENERGY ENGINEERING


Examination Committee:


.....Chairman
(Assoc. Prof. Dr. Tawatchai Charinpanitkul)

.....Member
(Assoc. Prof. Dr. Nakorn Tippayawong)

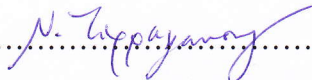
.....Member
(Assoc. Prof. Thawan Sucharitakul)

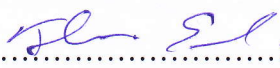
.....Member
(Asst. Prof. Dr. Det Damrongsak)

.....Member
(Assoc. Prof. Dr. Khajornsak Sopajaree)


.....Member
(Asst. Prof. Dr. Somporn Chantara)

Advisory Committee:

.....Advisor
(Assoc. Prof. Dr. Nakorn Tippayawong)

..... Co-advisor
(Assoc. Prof. Thawan Sucharitakul)

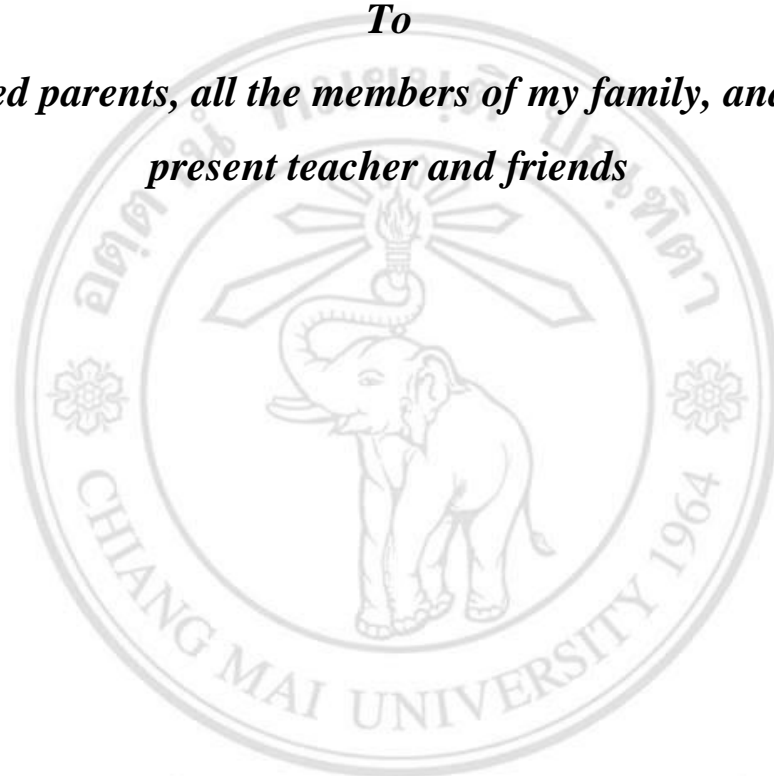
..... Co-advisor
(Asst. Prof. Dr. Det Damrongsak)

..... Co-advisor
(Assoc. Prof. Dr. Khajornsak Sopajaree)

5 April 2017

Copyright © by Chiang Mai University

To
My beloved parents, all the members of my family, and past and
present teacher and friends



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

ACKNOWLEDGEMENT

Part of this thesis has been funded by the National Science and Technology Development Agency (NSTDA) under "Modification, Calibration, and Field Testing of an Electrical Aerosol Size Spectrometer towards Commercialization (Phase 1) and (Phase 2)" which the co-advisor, Assoc. Prof. Dr. Panich Intra from Rajamangala University of Technology Lanna is the project leader. The author would like to gratefully thank Prof. Dr. Nakorn Tippayawong and friends in SUsustainable and Renewable Energy laboratory (SURE Lab.), and Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University for any recommendations during the study.

The author would like to thank staffs from Mae Moh Mine EGAT Thailand, Pollution Control Department (PCD) Thailand, and Innovative Instrument Co., Ltd. for help and support the comparing devices (TEOM, Beta ray, and light scattering devices) and the airborne PM measuring station.

The author would also like to acknowledge Rajamangala University of Technology Lanna, the Research Unit of Applied Electric Field in Engineering (RUEE), and Department of Chemical Engineering, Chulalongkorn University for support.

Last and most importantly, the author thank my family for their love and encouragement that sustained me throughout my work.

ลิขสิทธิ์โดยมหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Artit Yawootti