

## CONTENTS

# INTERNATIONAL & REGIONAL JOURNAL Page

---

❁ Preface	
❁ International & Regional Journal .....	1 - 37
❁ National Journal .....	39 - 71
❁ International Conference .....	73 - 195
❁ National Journal .....	197 - 293
❁ Author Index .....	295 - 315
❁ Title Index .....	317 - 358
❁ Appendix .....	359 - 361

## PREFACE

*In addition to teaching and service functions, King Mongkut's University of Technology Thonburi (KMUTT) regards research activities as one of its most important roles. As envisaged in one of KMUTT's visions approved by the University Council, "Determined to be at the Forefront of Technology and Research", the University is determined to be a higher education institution outstanding in the field of research, development and selection of suitable technology for the Thai economic and social context to create a happy Thai society competitive in the global community.*

*This forth collection of 710 KMUTT Research Abstracts for the year 2003 is one of the activities intended to support the above vision. These abstracts are also available through electronic access at website: [www.kmutt.ac.th](http://www.kmutt.ac.th) and the full papers of theme have been published in a variety of international and regional journals and proceedings.*

*I would like to extend my sincere thanks to all KMUTT researchers and administrative staff for their support, and for making this publication be of interest and benefit to the public and research communities.*

สาร: สจ ๑๖๒

เลขหมู่	607
	๗ 51
	2546
เลขทะเบียน	15451
วันที่	๒๔ ส.ย. ๒๕๕๑

๙๖๕๘๘

Research and Intellectual Property Promotion Center  
Institute for Scientific and Technological Research and Services  
King Mongkut's University of Technology Thonburi (KMUTT)

BSTI DEPT. OF SCIENCE SERVICE  
สำนักหอสมุดฯ กรมวิทยาศาสตร์บริการ



1110003254

ด้วยอภิสิทธิ์เฉพาะการ  
จาก

มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี

23 ส.ย. 2551