

MECHATRONICS

BOOK SERIES

SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 2

Editors

Md. Raisuddin Khan

Md. Mozasser Rahman

Muhammad Mahbubur Rashid

Shahrul Na'im Sidek



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CONTENTS

Editorial Notes	v
About the Editors	vi
Contents	vii
1. A Brief Overview of Biomechatronics and Its Applications.....	1
<i>Nur Izatulnisha A.Rashid, Jamaliah Kassim and Asan G. A. Muthalif</i>	
2. Self-Powered Solar Tracking System Part 1: System Modeling and Hardware Selections.....	7
<i>Asan G. A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
3. Self-Powered Solar Tracking System Part 2: System Design.....	14
<i>Asan G.A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
4. Self-Powered Solar Tracking System Part 3: System Integration and Testing.....	19
<i>Asan G.A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
5. Smart System For Monitoring Electrical Power Usage at Homes.....	25
<i>Kawthar A. Rahman, Asan G. A. Muthalif and Nurul F. Shua'ib</i>	
6. Vibration Based Predictive Maintenance: Common Rotating Machinery Faults and Their Signatures.....	30
<i>Siti F. Mansor, Asan G. A. Muthalif and Nurul 'I. Zaman</i>	
7. Modeling of Disc Rotor Induction Motor.....	38

M. M. Rashid, S. Abubakar and R. Tamjis

8. Computer Communication for a Smart Card Based Ordering System Via Visual Basic..... 52
Siti Fauziah Toha and Rosdiazli Ibrahim
9. Electronic Smart Ordering System: Graphical User Interface 59
Siti Fauziah Toha and Rosdiazli Ibrahim
10. Intruder Avoidance System Via Short Message Service (SMS)..... 65
Siti Fauziah Toha and Mohammad Zafran Haja Mohideen
11. Anti Skid Control System, A Tutorial..... 71
M. J. E. Salami, R. Khan, A.M. Aibinu, Syahrul Syazanizam Bin Md Said and Mohd Sofian Bin Basrah
12. Intelligent Anti Skid Control System..... 75
M. J. E. Salami, R. Khan, A.M. Aibinu, Syahrul Syazanizam Bin Md Said and Mohd Sofian Bin Basrah
13. Principles of FMCW Radar Signal Processing..... 91
Wahju Sediono and Andrian Andaya Lestari
14. Design and Implementation of a Simple Queueing System for Vehicle Traffic Simulator..... 99
Wahju Sediono
15. Determination of Target Speed from the FMCW Radar Data..... 107
Wahju Sediono and Andrian Andaya Lestari
16. Intelligent Egg Incubator: Introduction..... 116
Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang
17. Intelligent Egg Incubator: Mechanical Design..... 125

Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang

18. Intelligent Egg Incubator: System Integration And Results 137
Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang

19. Human Posture Recognition Classification And Recognition..... 157
Kyaw Kyaw Htike, Othman O. Khalifa and and Lai Weng Kin

20. Human Posture Recognition Preprocessing Techniques..... 162
Othman O. Khalifa, Kyaw Kyaw Htike, Lai Weng Kin and A. Albagoul

21. Path Detection Implementation Using Fuzzy Classifier 171
Imran Moez Khan, Yusof Zaw Zaw, Othman O. Khalifa and Lai Weng Kin

22. Mechanical Design Of Unmanned Underwater Vehicle 180
Md. Raisuddin Khan, M. Zuhdi and Masum Billah

23. Design And Development Of An Automated Café System..... 187
Md. Raisuddin Khan, MAS Kamal and Masum Billah

24. Speech Coding Using Compressive Sensing On A Multicore System 194
T.S. Gunawan, Othman O. Khalifa, A. A. Shafie and E. Ambikairajah

25. A Case For Cooperative Vision System..... 202
A. A. Shafie and N. Samudin

26. Path Following Autonomous Vehicle Based On Vision System..... 208
A. A. Shafie, E. A. Syukur and N. I. Sidek

27. Trajectory Planning Using Gps For Unmanned Aerial Vehicle With Microcontroller Based System 215
A. A. Shafie, Md. Raisuddin Khan and M Shehzad Islam

28. Digital Hearing Aids Analysis And Implementation.....	224
<i>Othman O. Khalifa, Aisha H. Abdalla and Sheroz Khan</i>	
29. Automatic Intelligent Ordering System: Design And Tools Selection	233
<i>Siti Fauziah Toha and Rosdiazli Ibrahim</i>	
30. Automatic Smart Card Purchasing System for Express Kiosk.....	240
<i>Siti Fauziah Toha and Rosdiazli Ibrahim</i>	
31. Finite Element Formulation of Piezoelectric Laminated Composite Plate	247
<i>Iskandar Al-Thani Mahmood and Md. Raisuddin Khan</i>	
32. A Review on Modeling And Shape Control Of Piezoelectric Laminated Composite Plate Using Finite Element Method.....	257
<i>Iskandar Al-Thani Mahmood and Md. Raisuddin Khan</i>	
33. Development of Auto Parking System & Auto Billing System Using Image Processing Technique (Part 1).....	267
<i>M. M. Rashid</i>	
34. Development of Auto Parking System and Auto Billing System Using Image Processing Technique (Part 2)	274
<i>M. M. Rashid</i>	
35. Development of Auto Parking System& Auto Billing System Using Image Processing Technique (Part 3).....	281
<i>M. M. Rashid</i>	
36. Automatic Car Parking Management System for Large Parking Lot.....	289
<i>M. M. Rashid</i>	
37. Development of Wireless Home Power Monitoring System	296
<i>M. M. Rashid</i>	

CHAPTER 11

ANTI SKID CONTROL SYSTEM, A TUTORIAL

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11.1 Introduction

Antiskid Braking System (ABS) refers to devices designed for preventing wheel lock during hard and panic braking conditions. These systems have gained attention in the recent time. Most Malaysian cars are equipped with an ABS [1-2]. It is a known fact that four wheel systems provide more security, steerability and stability. ABS systems are designed using system hydraulics, sensors and control electronics.

The antiskid braking system is basically an actuator used in controlling the valve and brake pressure fluid used for stopping cars. The main idea is to control the brake force not to exceed the wheel threshold limit where slip can occur. The vehicle speed and wheel speed play important role in making the car stop in safe way thus avoiding skidding. As long as the driver steps on the brake pedal, antiskid braking system will play its important action to prevent skidding.

Most modern ABS comprises of: Hydraulic brakes for wheels of the vehicle; Actuators provided for respective brake groups each including at least one of the brakes, for controlling a braking pressure or pressures of the brake or brakes of the corresponding groups; Speed sensors, at least one of which is provided corresponding to each actuator, for detecting speeds of the wheels [1-4]. A moving vehicle is affected by weight force, air resistance and voluble resistance of tire above all. The force actuating for tire include: Circumferential force, which is descended from driving mechanism; Side force, which is descended from vehicle control; Normal force, which is descended from vehicle weight.

The forces efficiency depends from road status, tire status and atmospheric conditions. The transferred force intensity between road and tire at accelerating or decelerating are determined by the friction forces. Car safety systems need maximum uses instantaneous value of the friction forces, which is determined by the adhesive force. If there is a high friction force, then more driving force of engine will gives the car more acceleration. If the value of friction force is small enough, the wheel will start to skid. In this case, the Antiskid Braking System (ABS) must reduce the engine driving force to some level if any wheel is skidding. In other words, the braking forces must be reduced so the vehicle stops from skidding.

The most important parameter processed in Antiskid Braking System is slip. The slip is non dimensional parameter designated as λ . This parameter determines the skid rate during braking. The general equation of slip is,