

MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah



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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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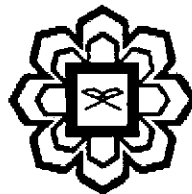
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EDITOR

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Table of Content

PREFACE	v
EDITOR	vi
SECTION 1: INTELLIGENT CONTROL SYSTEM	5
Chapter 1	6
Working Principle and Operating Mode of Atomic Force Microscopy Iskandar Al-Thani Mahmood	
Chapter 2	13
Design and Development of controller of Active Power Filter for Industrial Usage part 1 M.M.Rashid ¹ , N.A.Ramin ² and Zahurul ²	
Chapter 3	21
Design and Development of controller of Active Power Filter for Industrial Usage part 2 M.M.Rashid ¹ , N.A.Ramin ² and Zahurul ²	
Chapter 4	30
Design and Implementation of Instant Noodles Vending Machine M.M.Rashid	
Chapter 5	39
Development of Intelligent Belt Conveyor System (Part 1) M. M. Rashid, Faruok Alliays	
Chapter 6	45
Development of Intelligent Belt Conveyor System M.M.Rashid, Faruk, M J E Salami	
Chapter 7	50
Anti Skid Control System, A Tutorial M. J. E. Salami, A. M. Aibinu, A. F. Salami and Mohd Sofian Bin Basrah	
Chapter 8	54
Design and Prototyping of Inertia Wheel W. Astuti, A. R. Kasim, M. I. Solihin, A.M. Aibinu, Momoh Jimoh E.Salami and Wahyudi	
Chapter 9	62
Control of Automatic Drilling Machine by PLC Md Mozasser Rahman, Najiah Md Zain @Abdul Rahman and Mohd Syazwan Bin Jamil	
Chapter 10	74
Automatic Storage and Retrieval System Abdul Kadir Abdul Jabar Abdul Kadir, M. J. E. Salami and A. M. Aibinu	
Chapter 11	80
Control of Unmanned Underwater Vehicle Raisuddin Khan ^{1,a} , Faried Hasbullah ^{2,b} and Masum Billah ^{3,c}	
Chapter 12	85

Adaptive Sliding Mode Control for 3dof Helicopter Mostafa A. Hamood ^a , Rini Akmeliawati ^b	
Chapter 13	93
Backstepping Control of an Autonomous Quadrotor Norafizah Abas ¹ , Rini Akmeliawati ²	
Chapter 14	103
Piezoelectric Tube Scanner in Atomic Force Microscope Iskandar Al-Thani Mahmood	
SECTION II : INTELLIGENT CONTROL SYSTEM DESIGN	111
Chapter 15	112
A Review on Control of Two-Wheeled Wheelchair System Salmiah Ahmad ^{1, a} , M. O. Tokhi ^{2, b}	
Chapter 16	121
A Smart Car Surveillance System using Programmable Logic Controller (PLC) Siti Fauziah Tohaa and Mohammad Zafran Haja Mohideen	
Chapter 17	128
Design of Controller for Elevator Group Using Fuzzy Logic Part 1 M.M.Rashid, Azhar	
Chapter 18	133
Design of Controller for Elevator Group Using Fuzzy Logic Controller Part 2 M.M.Rashid, Azhar	
Chapter 19	139
Fuzzy Logic-based Intelligent Control of Flexible Link Manipulator Ismaila B. Tijani and Rini Akmeliawati	
Chapter 20	148
EEG based robot control A. Khorshidtalab and M. J. E. Salami	
Chapter 21	158
Visual-Based Intelligent Solar Tracking System Rini Akmeliawati*, Samir A. Abdul Kareem, Riza Muhida	
SECTION III: INTELLIGENT SYSTEM DESIGN	172
Chapter 22	173
Intelligent Air-conditioning System Amir A. Shafie, Raisuddin Khan, H. Al-haieaid M. Ebrahim	
Chapter 23	179
An Intelligent Car Surveillance System: Design and Tools Selection Siti Fauziah Toha ^a and Mohammad Zafran Haja Mohideen	
Chapter 24	185
Automatic Pipe Bursting Monitoring System M. J. E Salami, Syed Ahmed @ Hla Moe Win	

Chapter 25	194
Development of an Intelligent Laundry System	
Mohd Hafizi Azmi, Muhammad R. Affendy, M. J. E Salami and A.M. Aibinu	
Chapter 26	203
Development of Palmprint based Biometric System	
M. A. Rotinwa-Akinbile, A.M. Aibinu and M. J. E. Salami	
Chapter 27	213
Development of Smart Baby Chair	
M. J. E Salami, Fatanah M.S. and Fadiah Bt Ismail	
Chapter 28	219
Intelligent Automatic Fruit Identification System	
M. Aibinu, M. J. E. Salami, N. Hazali, N. Termidzi , and A. A. Shafie	
Chapter 29	229
Intelligent SCADA-Based Telemetry System for Monitoring and Controlling of Municipal Sewage Treatment Plant: IIUM, Gombak As a Case Study	
Momoh-J.E Salami. Abdulghafur A., Muhamad F. Sainal and Nasrodin T.. Mustapha. Ismaila B. Tijani	
Chapter 30	238
Development of Prototype Real-time system for SCADA-based Monitoring and Controlling System for Sewage Treatment Plant	
Momoh-J.E Salami, Abdulghafur A., Muhamad F. Sainal and Nasrodin T.. Mustapha. Ismaila B. Tijani	
Chapter 31	250
Intelligent Water Heater System	
M. J. E Salami and Khairul Ikram Bin Kamarul Bahrin	
Chapter 32	255
Machine Intelligence: MIQ, MSQ, and MEQ	
Nahrul Khair Alang Md Rashid and Khairul Affendy Md Nor	
Chapter 33	260
Coil Windings Determination Using Genetic Algorithm	
Abiodun Musa Aibinu, M. J. E Salami and Hafsat Farooqi	
Chapter 34	264
Determination of Material Depth Using Artificial Neural Network	
Aalya Banu, Sharmila Fathima and Nahrul Khair Alang Rashid	
Chapter 35	278
Design of Ink Refilling Machine For Marker Pen	
A. M. Aibinu, Rusnajaa Binti Mohd Yusoff And Liyana Bte Sani	
SECTION IV : MODELLING AND SIMULATION	283
Chapter 36	284
Hajj Crowd Simulation Based on Intelligent Agent	
Teddy Surya Gunawan ^{1,a} , Mira Kartiwi ^{2,b} , Willy Wahyu Mulyana ^{3,c}	

Chapter 37	292
Kernel PCA – An Introduction	
Hamza Baali ^{1,a} , Momoh-Jimoh Eyiomika Salami ^{2,b} , Rini Akmeliawati ^{3,c}	
Chapter 38	297
System Modelling of a Twin rotor System: Time and Frequency Domain Analysis	
Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b}	
Chapter 39	304
System Identification Technique for a Helicopter Using Genetic Algorithms	
Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b}	
Chapter 40	311
Advanced Noise Removal Techniques for the Detection of EMG Signal	
Md. Rezwanul Ahsan ^{1,a} , Muhammad Ibn Ibrahimy ^{2,b} and Othman Omran Khalifa ^{3,c}	
Chapter 41	322
Active suspension system: Part 1 - Mathematical Modelling	
Aiman O. Bajaber ^a , Asan G. A. Muthalif ^b , Ayman S.I. Elzubair ^c	
Chapter 42	327
Active Suspension System: Part 2 - Controller Design and Simulation	
Ayman S.I. Elzubair ^a , Asan G. A. Muthalif ^b , Aiman O. Bajaber ^c	
Chapter 43	332
Book Shelving Robotics	
M. J. E. Salami ^{1,a} , Mohd Farid Md Alias ^{2,b} , Nurul Izzah Sidek ^{3,c} , Mohamed Mousa ^{4,d}	
Chapter 44	337
Model Structure and Random Input for System Identification Technique for Flexible Manipulating System	
Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b}	
Chapter 45	344
Fault Tree Analysis, A case study of a simple Line Following Robot	
Abiodun Musa Aibinu, Haaris Ahmad Quadri, Mu Ham Mach A Mine, Almehmadi Tarig Saeed S And Hamide Rohimah	
Chapter 46	351
Review of Malaysian Traffic Summon and Payment system	
A. M. Aibinu, Sharifah Nadiyah bt Syed Mohammad, Wan Nur Faezah bin Wan Azmi	

Chapter 45

Fault Tree Analysis, A case study of a simple Line Following Robot

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45.1 Introduction

Fault tree analysis (FTA) is a top-down approach to failure analysis, starting with a potential undesirable event (accident) called a TOP event, and then determining all the ways it can happen [1]. FTA is used most often in: (1) root cause analysis which involves: identifying all relevant events and conditions leading to undesired events; determining parallel and sequential event combinations; Model diverse/complex event interrelationships involved (2) risk assessment which involve Calculating the probability of an undesired event (level of risk); Identify safety critical components/ functions / phases; measure effect of design changes (3) design safety assessment for demonstrating compliance with requirements; Showing where safety requirements are needed; identifying and evaluate potential design defects and determine common mode failures.

FTA allows the use of reliable information on component failure and other basic events to estimate the overall risk associated with new system designs for which no historical data exists and simple to understand and implement. It gives a qualitative descriptions of potential problems and combinations of events causing specific problems of interest and **quantitative** estimates of failure frequencies and likelihoods, and relative importances of various failure sequences and contributing events. FTA can be use to produce lists of recommendations for reducing risks and also in the quantitative evaluations of recommendation effectiveness.

Despite the extensive advantages associated with the use of FTA, it has some drawbacks among which are; it might be difficult to conceive all possible scenarios leading to the top event and construction of fault trees for large systems can be tedious. Furthermore, correlations between basic events (e.g. failure of components belonging to the same batch) are difficult to model and exact solutions to correlated events do not exist in some cases and subjective decisions regarding the level of detail and completeness are sometimes not easy to handle.

45.2 Simple Examples of FTA

In order to understand the detailed analysis of FTA, some basic examples will be presented in this chapter. These include simple series and parallel circuits.

Example 1

- 1) A basic circuit is shown in figure 44.1