

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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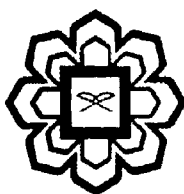
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Table of Content

Preface

Part I	Microstrip Antenna Design	Page
Chapter 1	Ultra Wideband Antennas <i>Muhammad Feroze Akbar J. Khan, Shaker MM. Al-Karaki, Md. Rafiqul Islam</i>	1
Chapter 2	Patch Antenna Parameters For Ultra Wideband Design <i>Muhammad Feroze Akbar J. Khan, Shaker MM. Al-Karaki, Md. Rafiqul Islam</i>	6
Chapter 3	Design Procedure for Microstrip Patch Antenna <i>Shaker MM. Al-Karaki, Muhammad Feroze Akbar J. Khan, Md. Rafiqul Islam</i>	13
Chapter 4	Design of Symmetrical Fed Patch UWB Antenna Using Partial Ground and Stairs <i>Md. Rafiqul Islam, AHM Zahirul Alam, Muhammad Feroze Akbar J. Khan and Shaker MM. Al-Karaki</i>	22
Chapter 5	Design of Symmetrical Fed Patch UWB Antenna Using Slotted Partial Ground And Stairs <i>Md. Rafiqul Islam, AHM Zahirul Alam, Muhammad Feroze Akbar J. Khan and Shaker MM. Al-Karaki</i>	33
Chapter 6	Design of Symmetrical Fed Patch UWB Antenna With Tuning Stub And Symmetrical Slotted Ground <i>Md. Rafiqul Islam, AHM Zahirul Alam, Muhammad Feroze Akbar J. Khan and Shaker MM. Al-Karaki</i>	40
Chapter 7	Design of Unsymmetrical Fed Patch UWB Antenna With Unsymmetrical Slotted Ground <i>Md. Rafiqul Islam, AHM Zahirul Alam, Shaker MM. Al-Karaki and Muhammad Feroze Akbar J. Khan</i>	49
Chapter 8	Ultra Wideband Antenna With Band Notch Using Asymmetrical Feedline <i>AHM Zahirul Alam and Md. Rafiqul Islam</i>	56
Chapter 9	Multi-Band Reconfigurable Antenna Using RF MEMS Switch <i>AHM Zahirul Alam and Md. Rafiqul Islam</i>	63
Chapter 10	Multi-Band Planar Patch Antenna <i>AHM Zahirul Alam and Md. Rafiqul Islam</i>	69
Chapter 11	Tuning Fork Type Planar Antenna <i>AHM Zahirul Alam and Md. Rafiqul Islam</i>	76
Chapter 12	Leaky-Wave Array Antenna <i>Mimi Aminah Wan Nordin, Hany E. Abd El-Raouf, AHM Zahirul Alam, Md. Rafiqul Islam</i>	83

Chapter 13	Overview of Smart Antenna System <i>Ibrahim A. Haji, Md. Rafiqul Islam, A.H. M. Zahirul Alam, Othman O. Khalifa Khaizuran Abdullah,</i>	
Chapter 14	Direction of Arrival Algorithms For Array Antenna Design <i>Ibrahim A. Haji, Md. Rafiqul Islam, A.H. M Zahirul Alam, Othman O. Khalifa, Khaizuran Abdullah</i>	97
Chapter 15	Analysis of Beamforming Algorithms <i>Ibrahim A. Haji, Md. Rafiqul Islam, A.H. M Zahirul Alam, Othman O. Khalifa and Khaizuran Abdullah</i>	108
Chapter 16	Design of Linear Array Antenna For Smart Antenna Application <i>Md. Rafiqul Islam, A.H. M Zahirul Alam, Othman O. Khalifa, Khaizuran Abdullah, Ibrahim A. Haji</i>	121

Part II Propagation Measurements and Modeling

Chapter 17	Propagation Path Loss Modeling For Wireless Applications <i>Ali Khadim, Jalel Chebil and Md Rafiqul Islam</i>	137
Chapter 18	Comparison between Measured and Predicted Path Loss For Mobile Communication in Malaysia <i>Jalel Chebil, Md Rafiqul Islam and Ali Khadim</i>	152
Chapter 19	Proposed Path Loss Models For Suburban Area in Kuala Lumpur <i>Jalel Chebil, Md Rafiqul Islam and Ali Khadim</i>	157
Chapter 20	Rain Rate Distribution For Microwave Link Design in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	164
Chapter 21	Rain Rate Conversion Factor in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	171
Chapter 22	A Matlab Program for Prediction of Rain Rate and Rain Attenuation Distributions in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	180
Chapter 23	Time-Delay Neural Network For Rainfall Forecasting <i>Kyaw Kyaw Htike, Othman O. Khalifa and Md. Rafiqul Islam</i>	186
Chapter 24	Development of One-Minute Rain Rate Contour Maps For Radiowave Propagation in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	193
Chapter 25	Rain Attenuation Measurements in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	201
Chapter 26	Propagation Study on Rain Attenuation at 18 GHz in Malaysia <i>Jalel Chebil and Tharek Abd. Rahman</i>	206
Chapter 27	Investigation Of Rain Attenuation At 38 GHz	214

	<i>Ahmad Fadzil Ismail and Khairayu Badron</i>	220
Chapter 28	Rain Attenuation Prediction Models For Earth-Space Link <i>Ahmad Fadzil Ismail and Khairayu Badron</i>	
Chapter 29	Development of A Modified Rain Attenuation Prediction Model <i>Ahmad Fadzil Ismail and Khairayu Badron</i>	226
Chapter 30	Antenna Losses Due To Rainfall And Its Effect On The Rain Attenuation Measurements <i>Jalel Chebil and Tharek Abd. Rahman</i>	233
Chapter 31	Modeling Of Wet Antenna Losses For Frequencies 15-38 GHz <i>Md. Rafiqul Islam, Jalel Chebil and Tharek Abdul Rahman</i>	239
Chapter 32	Path Length Reduction Factor For Rain Attenuation Prediction In Malaysia <i>Md. Rafiqul Islam, Jalel Chebil, Ahmad Fadzil Ismail and Tharek Abdul Rahman</i>	248
Chapter 33	Frequency Scaling Methods For Rain Attenuation Prediction <i>Md. Rafiqul Islam, Jalel Chebil, Ahmad Fadzil Ismail and Tharek Abdul Rahman</i>	256
Chapter 34	Proposed Frequency Scaling Method Based On Measured Rain Attenuation Data <i>Md. Rafiqul Islam, Jalel Chebil and Tharek Abdul Rahman</i>	269
Chapter 35	Analyses Of Rain Fade Characteristics For A 38 GHz Link In The Tropics <i>Ahmad Fadzil Ismail and Khairayu Badron</i>	278
Chapter 36	Worst-Month Statistics Modeling Based on Measured Data <i>Md. Rafiqul Islam, Jalel Chebil and Tharek Abdul Rahman</i>	285
Chapter 37	Worst-Month Rain Fade Statistics at 38 GHz <i>Ahmad Fadzil Ismail and Khairayu Badron</i>	298
Chapter 38	Rain Fade Slope Prediction Model Based On Satellite Data Measured In Malaysia <i>Md. Rafiqul Islam, Khalid Al-Khateeb, Sheroz Khan and Hassan Dao</i>	303
Chapter 39	Effects Of Rain On Free Space Optical Propagation <i>Suriza A.Z., Md. Rafiqul Islam, Wajdi Al-Khateeb and A.W. Naji</i>	310
Chapter 40	Investigation Of Solar Environment Effects On Space Assets & Satellite Signals <i>Othman O. Khalifa, Md. Rafiqul Islam, Jalel Chebil, Saad Bashir and Sivamohan A/L V.Shunmugam</i>	318

Chapter 23

Time-Delay Neural Network for Rainfall Forecasting

Kyaw Kyaw Htike¹, Othman O. Khalifa¹ and Md. Rafiqul Islam¹

23.1 Introduction

Accurate forecasts of the spatial and temporal distribution of rainfall are useful to convert one-minute rain intensity data for designing microwave link and predicting attenuation on microwave propagation. Chapter 22 has elaborated the procedure how to convert the data from annual statistics to one-minute statistics. However, rainfall is one of the most complex and challenging components of the hydrology cycle to comprehend and to forecast due to the various dynamic environmental factors and random variations both spatially and temporally[1]. There are several reasons why Artificial Neural Networks (ANN) are valuable and appropriate for use in such forecasting systems. Firstly, they are data-driven methods which have the ability to model both linear and non-linear systems without needing to make priori assumptions which are implicit in most classical statistical approaches such as the Box–Jenkins or ARIMA which assume that the time series under study are generated from linear processes, which is not the case in most real-world situations [2]. Secondly, they are capable of generalization. After learning the data that have been given to them during the training, they can often correctly estimate the unseen part of a population which is not part of the training data. Finally, they have been shown to be universal functional approximators and can approximate any continuous function to any desired accuracy.

23.2 Related Works

There have been many rainfall forecasting models developed based on the use of ANNs to implement the pattern recognition methodology. However, rainfall forecasting can apply to many time horizons such as short term [3], medium term, and long term periods [4] [5]. Some authors design systems which can forecast yearly data, some try to forecast monthly data [5] whereas some try to forecast daily data [6]. Most of them concentrate on one-step-ahead prediction. If multi-step prediction is then required, many iterations of one-step-ahead can be performed. The accuracy of the forecasts would of course decrease with the number of such iterations.

The traditional techniques for statistical weather forecasting include ARMA models, Box-Jenkins Models and Multivariate Adaptive Regression Splines [7]. When the machine learning became popular, there have been many attempts to build rainfall forecasting

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