



Topics in Coding, Cryptography and Information Security

Editors:

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Contents

List of Contributors	ii
Editorial Introduction	vi

PART I: SOURCE CODING

1. Performance Analysis of Image Data Compression using Zero-Tree Wavelet Transform	2
<i>Othman O. Khalifa, Emir Tabakovic, Zlatko Memisevic and Aisha-Hassan Abdullah</i>	
2. Scalable and Robust Streaming Video System Challenges	12
<i>Othman O. Khalifa, Sinzobakwira Issa and Mohammad Umar Siddiqi</i>	

PART II: CHANNEL CODING

3. Golay Codec: An Overview	23
<i>Othman O. Khalifa</i>	
4. Reed-Muller Codes: An Overview	35
<i>Othman O. Khalifa</i>	
5. Viterbi Decoder: A Review and Implementation	42
<i>Noorainani Ainina Bt. Md Noor Albakri and Othman O. Khalifa</i>	

6.	Zigzag Codes: High Rate Low Complexity Iterative Codes <i>Sigit P.W. Jarot</i>	53
7.	Convolutional Coded OFDM in Broadband Mobile Communication <i>Sigit P.W. Jarot</i>	66
8.	Channel Coding Techniques in Mobile Communication Systems <i>Othman O. Khalifa and Rashid A. Saeed</i>	77
9.	Channel Coding in CDMA 2000 <i>Othman O. Khalifa</i>	85
10.	Channel Coding in Mobile WiMAX <i>Rashid A. Saeed and Othman O. Khalifa</i>	91
11.	Turbo Codes: An Error Correction Technique for 4G <i>Mosharraf Hussain Masud and Mohammad Umar Siddiqi</i>	99
12.	Combined Source Channel Decoding for Image Transmission over Noisy Channels <i>Jalel Chebil</i>	108

PART III: CRYPTOGRAPHY AND INFORMATION SECURITY

13.	Cryptographic Boolean Functions: Transform Domain Perspective <i>Hashum Mohamed Rafiq and Mohammad Umar Siddiqi</i>	120
14.	Implementation of RSA Algorithm <i>Hafizul Azizi Rasid, Mohd Azmi Jabar and Othman O. Khalifa</i>	141
15.	GSM Security: Problems and Solutions <i>Rashid A. Saeed and Othman O. Khalifa</i>	152
16.	Recent Approaches to Wireless Physical Layer Security <i>M. Tahir, Sigit P.W. Jarot and M.U. Siddiqi</i>	161
17.	Securing OFDM-based Systems from the Physical Layer <i>Sigit P.W. Jarot</i>	169
18.	Simulation of Artificial Noise based Physical Layer Security <i>Muhammad Izzat bin Zurkiple and Sigit Puspito Wigati Jarot</i>	174

19. Secure IPv6 Address Generation 183
Nashrul Hakiem, Mohammad Umar Siddiqi, and Sigit Puspito Wigati Jarot
20. Video Streaming and Encrypting Algorithms 190
Mohammed Abumuala, Othman O. Khalifa, and Aisha-Hassan A. Hashim
21. Wireless IP Camera based on Motion Detection Surveillance System 217
Zeeshan Shahid and Khaizuran Abdullah
22. Design of Mobile Phone Jammer 223
Fauzum Abdullah Asuhaimi, Nur Fatin Mohd Zakki, and Khaizuran Abdullah

Index

Chapter 20

Video Streaming and Encrypting Algorithms

Mohammed Abumuala, Othman O. Khalifa,
and Aisha-Hassan A. Hashim

20.1. Introduction

The growth of popular web sites serving multimedia contents has led to the increase of video streaming applications. The challenges of multimedia data encryption come from two facts. First, the multimedia data is large (for example, the size of a two-hour MPEG-1 video is about 1 GB). Secondly, multimedia data needs to be processed in real time (for example, the data rates of MPEG-2 can go up to 40 Mbps or more). Processing vast amount of data in very short time puts great burden on video codec, storage space requirements and network communications. Heavy-weight encryption and decryption algorithms (during or after encoding phase) will aggravate the problem and increase the latency. For commercial applications such as pay-per-view video, very expensive attacks of the scrambled multimedia data are not interesting to the attackers because most videos are not as valuable as military secrets or financial information [1]. In such cases, the information rate is very high, but the information value is very low [1]. The cost to break such encryption code is much higher than the cost to buy the programs. Security is a trade-off between the cost of the data being protected and the cost attackers pay to get that data. The costs of a multimedia security system include the amount of investment by data provider and the payment required for customer service.

20.2. Image and Video Coding

Image and video encryption are of course closely related by the fact that raw video data consists of a sequence of still images. However, compressed video like the MPEG format is composed of different types of data which can be treated in specific ways by special encryption schemes. In MPEG-1 video coding model [2], a video is composed of a sequence of group of pictures (GOPs). Each GOP is a series of I, P and B pictures. I pictures are intraframe coded without any reference to other pictures. P pictures are predicatively coded using a previous I or P picture. B pictures are bidirectionally interpolated from both the previous and following I and/or P pictures. The relative frequency of occurrence of I, P and B pictures can be controlled by the applications.

Each picture is divided into macroblocks. A macroblock is a 16×16 pixel array. Macroblocks belonging to I pictures are spatially encoded. Those belonging