

# SELECTED TOPICS IN ADVANCED ELECTRONICS

Edited by  
Khalid A. S. Al-Khateeb



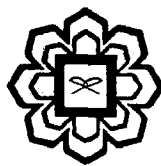
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**ADVANCED ELECTRONICS**

**CONTENTS**

Chapter 1 .....	1
WIRELESS CONNECTIVITY OF PC PERIPHERALS USING ULTRAWIDE BAND (UWB) PULSES	
Khalid A. S. Al-Khateeb and Ahmed Ramzi Mohammed	
Chapter 2 .....	11
VOLTAGE CONTROLLED OSCILLATOR FOR STANDARD GSM USING MEMS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 3 .....	23
MEMS SURFACE ACOUSTIC WAVES OSCILLATOR	
<b>Jamilah Karim, Anis Nurashikin Nordin and AHM Zahirul Alam</b>	
Chapter 4 .....	37
USING MEMS IN CLASS D AMPLIFIERS FOR STANDARD GSM CARRIER	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 5 .....	52
MEMS CAPACITIVE ULTRASONIC TRANSDUCERS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 6 .....	57
DESIGN OF MEMS CANTILEVER ENERGY HARVESTER	
<b>Anis Nurashikin Nordin and Aliza Aini Md Ralib</b>	
Chapter 7 .....	67
THEORY OF QUANTUM CRYPTOGRAPHY	
<b>Ali Sallami and Khalid A. S. Al-Khateeb</b>	
Chapter 8 .....	77
QUANTUM KEY DISTRIBUTION PROTOCOLS	
<b>Ali Sallami and Khalid A. S. Al-Khateeb</b>	

Chapter 9.....	84
FPGA CONTROL OF QUANTUM CHANNEL SECURITY	
<b>Khalid A. S. Al-Khateeb and Mohammed Munther A. Majeed</b>	
Chapter 10.....	97
THE DECOY STATE METHOD IN QUANTUM KEY DISTRIBUTION	
<b>Ali Sallami, Khalid A. S. Al-Khateeb and Mohamad Ridza Wahiddin</b>	
Chapter 11.....	120
EAVESDROPPING ATTACKS ON QKD CHANNELS	
<b>Ali Sallami and Khalid A. S. Al-Khateeb</b>	
Chapter 12.....	126
SECURITY PERFORMANCE OF QKD	
<b>Sellami Ali and Khalid A. S. Al-Khateeb</b>	
Chapter 13.....	132
THEORETICAL ANALYSIS OF A DOUBLE STAGES ERBIUM DOPED FIBER AMPLIFIER	
<b>Khalid A. S. Al-Khateeb and M. A. Mohammed</b>	
Chapter 14.....	142
THEORY OF ERBIUM DOPED FIBER LASERS (EDFLS) AND ERBIUM DOPED FIBER AMPLIFIERS (EDFAS)	
<b>Sallami Ali and Khalid A. S. Al-Khateeb</b>	
Chapter 15 .....	175
ERBIUM DOPED FIBER LASERS WITH DOUBLE TUNABLE BANDPASS FILTER	
<b>Ali Sallami, Khalid Al-Khateeb and Bouzid Billoui</b>	
Chapter 16.....	181
ERBIUM DOPED FIBER AMPLIFIER WITH A QUADRUPLE PASS	
<b>Sellami Ali, Khalid A. S. Al-Khateeb and Bouzid Billoui</b>	
Chapter 17.....	189
TRANSPARENT ELECTRODES FOR OPTOELECTRONIC DISPLAYS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 18.....	201
EPITAXIAL GROWTH OF THIN ZnS FILMS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 19.....	211
MODERN ELEECTRONIC DISPLAY SYSTEMS	
<b>Khalid A. S. Al-Khateeb and Moaaz Elhag Ali</b>	

Chapter 20.....	230
AVALANCHE PHOTO DIODES AS SINGLE PHOTON DETECTORS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 21.....	243
COOLING TECHNIQUES FOR SINGLE PHOTON AVALANCHE DIODE	
<b>Nurul Fadzlin Hasbullah, Nurul Izzati Samsuddin and Salmiah Ahmad</b>	
Chapter 22.....	256
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA) USING MICROCONTROLLER	
<b>Khalid A. S. Al-Khateeb and Mohamad Azman Shah</b>	
Chapter 23.....	268
ELECTRONIC REMOTE MONITORING OF INDUSTRIAL SYSTEMS	
<b>Khalid A. S. Al-Khateeb</b>	
Chapter 24.....	276
MEDICAL CARE SYSTEM FOR REMOTE MONITORING OF FOETAL ECG	
<b>Khalid A. S. Al-Khateeb and Mohammed I. Ibrahimy</b>	
Chapter 25.....	287
INTELLIGENT AUTO TRACKING IN 3D SPACE BY IMAGE PROCESSING	
<b>Khalid A. S. Al-Khateeb and Othman O. Khalifa</b>	
Chapter 26.....	300
CIRCUIT DESIGN FOR RADIO FREQUENCY IDENTIFICATION DEVICES (RFID)	
<b>Aisyah Jaafar, Nurul Syuhadah Izwar Arfani and Othman O. Khalifa</b>	
Chapter 27.....	309
DYNAMIC TRAFFIC LIGHT SEQUENCE ALGORITHM USING RFID	
<b>Khalid A. S. Al-Khateeb, Jaiz A.Y. Johari and Wajdi F. Al-Khateeb</b>	
Chapter 28.....	326
ADVANCED RFID SECURITY FRAMEWORK FOR DYNAMIC TRAFFIC MANAGEMENT	
<b>Khalid A. S. Al-Khateeb, Jaiz A. Y. Johari</b>	
Chapter 29.....	337
MODELING CMOS WAFER PRODUCTION LINE USING PROMODEL SOFTWARE	
<b>Khalid A. S. Al-Khateeb and Khairul Hakim B. Zainiddin</b>	

Chapter 30.....	348
ASIC DESIGN FLOW	
<b>Sreedharan Baskara Dass, Aisha_Hassan A. Hashim and Loay Faisal</b>	
 Chapter 31.....	 355
ELECTRONIC DESIGN AUTOMATION TOOLS	
<b>Sreedharan Baskara Dass, Aisha_Hassan A. Hashim and Loay Faisal</b>	
 Chapter 32.....	 365
CIRCUIT DESIGN OF A CLOCK DATA RECOVERY	
<b>Z. M. Ashari and Anis N. Nordin</b>	
 Chapter 33.....	 376
EFFECTS OF NEUTRON IRRADIATION ON VARIOUS ELECTRONIC DEVICES	
<b>Nuurul Iffah Che Omar and Nurul Fadzlin Hasbullah</b>	
 Chapter 34.....	 384
NEUTRON SOURCE AND NEUTRON SHIELDING	
<b>Nuurul Iffah Che Omar and Nurul Fadzlin Hasbullah</b>	
 Chapter 35.....	 390
QUANTUM DOTS AS A SOLUTION TO RADIATION HARDNESS	
<b>Nuurul Iffah Che Omar and Nurul Fadzlin Hasbullah</b>	

## CHAPTER 13

# THEORETICAL ANALYSIS OF A DOUBLE STAGES ERBIUM-DOPED FIBER AMPLIFIER

By

**Khalid A. S. Al-Khateeb and M. A. Mohammed**

Electrical and Computer Engineering Department, Faculty of Engineering,  
International Islamic University Malaysia,  
53100 Gombak, Kuala Lumpur,  
Malaysia

### Synopsis

A model of an Erbium Doped Fiber Amplifier (EDFA) configured in Dual Stages (DS) scheme with Tunable Band Pass (TBF) is presented. A circulator is used to reflect the amplified signal back to the Erbium-doped fiber and which is incorporated with Tunable band pass filter (TBF) which filter-out Amplified Spontaneous emission in order to ensure efficient amplification of the signal as it propagates along the fiber. Laser diodes operating at 1480 nm with 10 mW and 220 mW are using to pump the double stages. In addition, design parameters of EDFA are optimized using the numerical simulation of EDFA rate equation model in order to optimize the performance of the EDFA. Thus, the proposed amplifier configuration is able to maintain gain of higher than 64 dB for small signals less than -45 dBm using wavelength 1550 nm. Design and analysis of the performance of the EDF and enhancement the optical fiber communication system performance can be achieved by using developed model.

### 1. Introduction

The availability of practical laser diode pump sources have made EDFAs ideal for 1550 nm wavelength [1]. The attractive features of EDFAs consist in their high gain, high-output saturation, wide optical bandwidth, low insertion loss, near quantum limited noise, polarization-independence and immunity to saturation-induced crosstalk [2]. Despite of,