PROCEEDINGS

OF 14TH INTERNATIONAL CONFERENCE ON COMMUNICATIONS, ELECTROMAGNETICS AND MEDICAL APPLICATIONS (CEMA'19)

Organized by:

FACULTY OF TELECOMMUNICATIONS
TECHNICAL UNIVERSITY OF SOFIA, BULGARIA

NATIONAL TECHNICAL UNIVERSITY OF ATHENS, GREECE,
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

NATIONAL TECHNICAL UNIVERSITY OF ATHENS, GREECE

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

Sofia, Bulgaria
17th – 19th October, 2019

KING 2001, Sofia

Edited by Prof. Dr. Eng. **Dimiter Tz. Dimitrov**

All rights reserved. This book, or parts there of, may not be reproduced in any form or by any means, electronic or mechanical, including photocoying or any information starage and the retrieval system now known or to be invented without written permission from the Publisher.

ISSN: 1314-2100

SCOPUS Indexing
http://suggestor.step.scopus.com/progressTracker, ID: 6B4F77263D276412.

Printed in Bulgaria
KING 2001, Sofia

P. Frangos

D. Dimitrov

K. Dimitrov

Dear Colleagues,

It is our privilege to thank all of you for your contributions submitted at 14th regular International Conference on 'Communication, Electromagnetic and Medical Applications' CEMA'19. This is a conference which should help future collaboration in the area of engineering, especially in the area of communication technologies and medical applications. This is an important scientific event not only in Balkan region, but in Europe, also. The International Conference on Communication, Electromagnetism and Medical Applications CEMA'19 is dedicated to all essential aspects of the development of global information and communication technologies, and their impact in medicine, as well. The objective of Conference is to bring together lecturers, researchers and practitioners from different countries, working on the field of communication, electromagnetism, medical applications and computer simulation of electromagnetic field, in order to exchange information and bring new contribution to this important field of engineering design and application in medicine. The Conference will bring you the latest ideas and development of the tools for the above mentioned scientific areas directly from their inventors. The objective of the Conference is also to bring together the academic community, researchers and practitioners working in the field of Communication, Electromagnetic and Medical Applications, not only from all over Europe, but also from America and Asia, in order to exchange information and present new scientific and technical contributions.

Many well known scientists took part in conference preparation as members of International Scientific Committee or/and as reviewers of submitted papers. We would like to thank all of them for their efforts, for their suggestions and advices.

On behalf of the International Scientific Committee, we would like to wish you successful presentations of your papers, successful discussions and new collaborations for your future scientific investigations.

Engineering and medicine should provide high level of living for all people.

D. Dimitrov
Conference Chairman

P. Frangos
Conference Vice Chairman

K. Dimitrov
Conference Vice Chairman

INTERNATIONAL SCIENTIFIC COMMITTEE

Chairman:

D. TZ. DIMITROV, Technical University of Sofia, Bulgaria

Vice Chairmen:

P. FRANGOS, National Technical University of Athens, Greece
K. L. DIMITROV, Technical University of Sofia, Bulgaria

Members

N. AMPILOVA,	University of Petersburg, Russia
T. AVOYAGI,	Tokyo Institute of Technology, Japan
A. BEKJARSKY,	Technical University of Sofia, Bulgaria
E. BOEMO,	University Authonoma, Barcelona, Spain
R. BRUZGIENE,	Kaunas University of Technology, Lithuania
N. DIB,	Jordan University of Science and Technology, Aman, Jordan
V. DUMBRAVA,	Kaunas University of Technology, Litvania
N. ESCUDEIRO,	ISEP, Porto, Portugal
E. GAGO-RIBAS,	University of Oviedo, Spain
V. GEORGIEVA,	Technical University of Sofia, Bulgaria
G. GOUSSETIS,	Heriot - Watt University, United Kingdom
S. V.HOEYE,	University of Oviedo, Spain
I. ILIEV,	Technical University of Sofia, Bulgaria
F. KLETT,	Franhofer Institute, Ilmenau, Germany
G. KLIROS,	Hellenic Air-Force Academy, Athens, Greece
V. KUKENSKA,	Technical University of Gabrovo, Bulgaria
L. LUBIH,	Technical University of Sofia, Bulgaria
G. MALLET,	University "Sophia Antipolis", Nice, France
G. MATSOPOULOS,	National Technical University of Athens, Greece
M. MARTINS,	Academia Militar da Amadora, DCEE, Portugal
M.– J. MORALES-GONZALES,	University of Valladolid, Spain
L. NARBUTAITE,	Kaunas University of Technology, Lithuania
K. NIKITA,	National Technical University of Athens, Greece
M. NIKOLOVA,	High Naval School, Varna, Bulgaria
A. PANAGOPOULOS,	National Technical University of Athens, Greece
J. PETROVSKA,	Medical University of Sofia, Bulgaria
H. ROTH,	University of Siegen, Germany
S. SAUTBEKOV,	Euroasian University, Astana, Kazakhstan
A. SAVOV,	Medical University of Sofia, Bulgaria
S. SAVOV,	Technical University of Varna, Bulgaria
H.-P. SCHADE,	Technical University of Ilmenau, Germany
I. SOLOVIEV,	University of St. Petersburg, Russia
L. SONG,	Technical University of Harbin, China
G. STAMATAKOS,	National Technical University of Athens, Greece
A. USHEVA,	University of Boston, USA
R. VERDONE,	University of Bologna, Italy

REVIEWERS

BALZANO, Q.	University of Maryland, USA
BEHARI, J.	Jawaharlal Nehru University ,New Delhi, India
BOEMO, E.	Technical University of Madrid, Spain
DIMITROV, D.	Technical University of Sofia, Bulgaria
DONTSCHEWA, M.	University of Applied Sciences, Dorbirn, Austria
GOUSSETIS, G.	Heriot - Watt University, United Kingdom
MALLET, G.	University "Sophia Antipolis", Nice, France
PETROVSKA, J.	Medical University of Sofia, Bulgaria
PRATO, F.	University of Western Ontario, Canada
ROTH, H.	University of Siegen, Germany
SAVOV, A.	Medical University of Sofia, Bulgaria
SCHADE, H-P.	Technical University of Ilmenau, Germany
SONG, L.	Technical University of Harbin, China
USHEVA, A.	University of Boston, USA

REGISTRATION

October, 17th, 09h 30min – 16h

The conference registration desk will be at:
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

CONFERENCE PROGRAM

17th October

OPENING CEREMONY

10h – 10h 30min
The conference registration desk will be at:
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

SCIENTIFIC PROGRAM

17th October

FIRST SESSION

10h 30min – 12h
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

Chairman: Prof. P. Frangos, School of Electrical and Computing Engineering, National Technical University of Athens, Greece

---

1. **FREQUENCY DEPENDENCY OF MULTIPATH FADING OVER THE SEA UNDER DUCTING. PART I: SIMULATION RESULTS FOR REFRACTIVITY PROFILES' PARAMETERS INFLUENCE**
   Irina SIRKOVA, Laser Radars Lab, Institute of electronics, Bulgarian Academy of Sciences, Bulgaria

2. **FREQUENCY DEPENDENCY OF MULTIPATH FADING OVER THE SEA UNDER DUCTING. PART II: SIMULATION RESULTS FOR SEA SURFACE ROUGHNESS INFLUENCE**
   Irina SIRKOVA, Laser Radars Lab, Institute of electronics, Bulgarian Academy of Sciences, Bulgaria

3. **IMPROVING THE PERFORMANCE OF TURBULENT FREE SPACE OPTICAL LINK BY USING A FOURIER FILTER**
   Jassim Mohammed Jassim, R. N. Ali, A. B. Sharba, Mariam Kadhim Jawad, and Khalid Mahdi Jasim, College of Science for Women/Laser Physics Depart./University of Babylon/Iraq

4. **METHODOLOGY AND ARCHITECTURE OF A COMPUTER-BASED INTERACTIVE TIMING SYSTEM FOR APPLICATIONS IN MEDICINE**
   Maria Angelova, Technical University – Sofia, Kalin Dimitrov, Technical University – Sofia, Stefan Valyukov, Therapist, Bulgaria

5. **INNOVATIVE BIOMONITORING SYSTEMS IN THE AEROSPACE INDUSTRY**
   Evgeni Andreev, Veselka Radeva, Mariya Nikolova, "N. Y. Vaptsarov" Naval Academy, Varna, Bulgaria

6. **X-RAY IMAGE PROCESSING FOR TISSUE INVOLVEMENT-BASED CARIES DETECTION**
   Veska Georgieva, Technical University of Sofia, Bulgaria, Plamen Petrov, Technical University of Sofia, Bulgaria, Barna Iantovics, University of Medicine, Pharmacy, Sciences and Technology, of Targu Mures, Romania

Lunch

12h – 13h30min

SECOND SESSION

13h 30min – 15h
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

Chairman: Prof. V. Georgieva, Faculty of Telecommunication, Technical University of Sofia, Bulgaria

---

1. **SEA STATE DETERMINATION USING NORMALIZED EXPERIMENTAL ONE – DIMENSIONAL RADAR SIGNATURES AT X – BAND AND FRACTAL TECHNIQUES**
   G. Pouraimis, A. Kotopoulis*, N. Ampilova**, I. Soloviev**, E. Kallitsis* and P. Frangos*, School of Electrical and Computing Engineering, National Technical University of Athens, Greece* Computer Science Department, St. Petersburg State University, Russia***

2. **ON THE APPLICATION OF MULTIFRACTAL METHODS FOR THE ANALYSIS OF SEA SURFACE IMAGES RELATED TO SEA STATE DETERMINATION**
   N. Ampilova, I. Soloviev*, Apostolos Kotopoulis**, George Pouraimis**, Panayiotis Frangos**, Computer Science Department, St. Petersburg State University, Russia*, School of Electrical and Computer Engineering,National Technical University of Athens, Greece***

3. **ANALYSIS OF IMAGES OBTAINED BY CAPILLARY DYNAMOLYSIS METHOD**
   I. Murenin, N. Ampilova, Computer Science Department, St. Petersburg State University, Russia

4. **MODELING OF THE DYNAMICS OF CHANGED PARTICLES USING UNITY ENGINE**
   M. Syasko, I. Soloviev, Computer Science Department, St. Petersburg State University, Russia

5. **IMPROVED ALGORITHM FOR CALCULATING GEOMETRIC CHARACTER-ISTICS FROM OPTICAL IMAGES CORRODED OBJECT'S CROSS-SECTION**
   Borislav Bonev, Anna Stoynova*, Antonio Shopov**, Department of Microelectronics*, Department of Strength of materials**, Technical University of Sofia*

6. **WILD ANIMALS POPULATION ESTIMATION FROM THERMOGRAPHIC VIDEOS USING TENSOR DECOMPOSITION**
   Ivo Draganov, Rumen Mironov, Nikolay Neshov, Agata Manolova, Radiocommunications and Videotechnologies Dept., Faculty of Telecommunications, Technical University of Sofia

Break
15h – 15h 30min

THIRD SESSION

15h 30min – 17h
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

Chairman: Prof. N. Ampilova, St. Petersburg State University, St. Petersburg, Russia

---

1. **SIGNAL PROCESSING AND STORING OF HIGH DYNAMIC RANGE ACOUSTIC DATA FOR KNOWLEDGE DISCOVERY**
   I. Simeonov, T. Trifonov*, T. Georgieva-Trifonova**, Vasil Levski National Military University, Veliko Tarnovo,Bulgaria*, Cyril and St. Methodius University of Veliko Tarnovo, Faculty of Mathematics and Informatics, Veliko Tarnovo, Bulgaria***

2. **AN EXPERIMENTAL STUDY OF IMPROVING SOUND INSULATION INDEX OF HOLLOW BRICK WALL BY USING WALL LINING PANELS FOR ACOUSTIC SENSITIVE ROOMS IN HOSPITAL**
   Snezhana Pleshkova, Aleksandar Vasilev Kirechev, Faculty of Telecommunications, Technical University of Sofia,Bulgaria

3. **COMPARISON BETWEEN APPLICATION OF GIRDLE COIL AND SEVERAL LOCAL INDUCTORS IN MAGNETOTTEHRAPY**
   Dimitar Dimitrov, Faculty of Telecommunications, Technical University of Sofia,Bulgaria

4. **SOME POSSIBILITIES FOR OPTIMISATION OF APPLICATION OF GIRDLE COIL IN MAGNETOTHERAPY**
   Sasho Guergov, Atanas Dimitrov, Technical University of Sofia, Bulgaria

5. **ONE APPLICATION OF INFLUENCE OF LOW FREQUENCY MAGNETIC FIELD ON THE HEAD**
   Atanas Dimitrov, Sasho Guergov, Technical University of Sofia, Bulgaria

CLOSING CONFERENCE SESSIONS

17h – 17h 30min
Building of Library, fourth floor
Technical University of Sofia, Bulgaria

SOCIAL PROGRAM

- **Conference Dinner**, 19h, October, 17th
- **Trip**, October, 18th.

More information regarding Conference dinner and trip will be provided during the first day of the Conference (October 17th)

CONTACT US:

http://rcvt.tu-sofia.bg/CEMA/eth.html

Prof. Dr. Dimiter Dimitrov

Faculty of Telecommunication
Technical University of Sofia
8, Kliment Ohridsky str.
1756 Sofia, Bulgaria
Phone:++359 2 9652278
Fax: ++359 2 9652278
E-mail: dcd@tu-sofia.bg

Prof. P. Frangos

National Technical University of Athens
School of Electrical and Computer Engineering
9, Iroon Polytechniou Str. ,
157 73 Zografou, Athens, Greece
Phone : 00 30 210 772 3694
Fax : 00 30 210 772 2281
E-mail: pfrangos@central.ntua.gr

TABLE OF CONTENTS

1. **FREQUENCY DEPENDENCY OF MULTIPATH FADING OVER THE SEA UNDER DUCTING. PART I: SIMULATION RESULTS FOR REFRACTIVITY PROFILES' PARAMETERS INFLUENCE** 1
Irina Sirkova

2. **FREQUENCY DEPENDENCY OF MULTIPATH FADING OVER THE SEA UNDER DUCTING. PART II: SIMULATION RESULTS FOR SEA SURFACE ROUGHNESS INFLUENCE** 6
Irina Sirkova

3. **IMPROVING THE PERFORMANCE OF TURBULENT FREE SPACE OPTICAL LINK BY USING A FOURIER FILTER** 10
Jassim Mohammed Jassim, R. N. Ali, A. B. Sharba, Mariam Kadhim Jawad, Khalid Mahdi Jasim

4. **METHODOLOGY AND ARCHITECTURE OF A COMPUTER-BASED INTERACTIVE TIMING SYSTEM FOR APPLICATIONS IN MEDICINE** 14
Maria Angelova, Kalin Dimitrov, Stefan Valyukov

5. **INNOVATIVE BIOMONITORING SYSTEMS IN THE AEROSPACE INDUSTRY** 17
Evgeni Andreev, Veselka Radeva, Mariya Nikolova

6. **X-RAY IMAGE PROCESSING FOR TISSUE INVOLVEMENT-BASED CARIES DETECTION** 22
Veska Georgieva, Plamen Petrov, Barna Iantovics

7. **SEA STATE DETERMINATION USING NORMALIZED EXPERIMENTAL ONE – DIMENSIONAL RADAR SIGNATURES AT X – BAND AND FRACTAL TECHNIQUES** 27
G. Pouraimis, A. Kotopoulis, N. Ampilova, I. Soloviev, E. Kallitsis, P. Frangos

8. **ON THE APPLICATION OF MULTIFRACTAL METHODS FOR THE ANALYSIS OF SEA SURFACE IMAGES RELATED TO SEA STATE DETERMINATION** 32
N. Ampilova, I. Soloviev, Apostolos Kotopoulis, George Pouraimis, Panayiotis Frangos

9. **ANALYSIS OF IMAGES OBTAINED BY CAPILLARY DYNAMOLYSIS METHOD** 36
I. Murenin, N. Ampilova

10. **MODELING OF THE DYNAMICS OF CHANGED PARTICLES USING UNITY ENGINE** 41
M. Syasko, I. Soloviev

11. **IMPROVED ALGORITHM FOR CALCULATING GEOMETRIC CHARACTERISTICS FROM OPTICAL IMAGES CORRODED OBJECT'S CROSS-SECTION** 46
Borislav Bonev, Anna Stoynova, Antonio Shopov

12. **WILD ANIMALS POPULATION ESTIMATION FROM THERMOGRAPHIC VIDEOS USING TENSOR DECOMPOSITION** 52
Ivo Draganov, Rumen Mironov, Nikolay Neshov, Agata Manolova

13. **SIGNAL PROCESSING AND STORING OF HIGH DYNAMIC RANGE ACOUSTIC DATA FOR KNOWLEDGE DISCOVERY** 58
I. Simeonov, T. Trifonov, T. Georgieva-Trifonova

14. **AN EXPERIMENTAL STUDY OF IMPROVING SOUND INSULATION INDEX OF HOLLOW BRICK WALL BY USING WALL LINING PANELS FOR ACOUSTIC SENSITIVE ROOMS IN HOSPITAL** 63
Snezhana Pleshkova, Aleksandar Vasilev Kirechev

15. **COMPARISON BETWEEN APPLICATION OF GIRDLE COIL AND SEVERAL LOCAL INDUCTORS IN MAGNETOTTEHRAPY** 68
Dimitar Dimitrov

16. **SOME POSSIBILITIES FOR OPTIMISATION OF APPLICATION OF GIRDLE COIL IN MAGNETOTHERAPY** 72
Sasho Guergov, Atanas Dimitrov

17. **ONE APPLICATION OF INFLUENCE OF LOW FREQUENCY MAGNETIC FIELD ON THE HEAD** 76
Atanas Dimitrov, Sasho Guergov