Triennial Report of Commission B

Lot Shafai
Commission Chair
June 21, 2008

This triennial covering the period of October 2005 to August 2008 was exceptionally busy for Commission B. The Commission organized two conferences in 2007 and in 2008 the technical section of Commission B for the General Assembly in Chicago. The two conferences in 2007 were the Commission's international conference the "Electromagnetic Theory Symposium, EMTS", and the North American URSI conference, a joint meeting of the "Canadian and US" URSI national committees. Both conferences were held in Ottawa, Canada. Commission B also initiated five (5) student's best paper awards, to be selected from among papers submitted to the General Assembly in Chicago. The value of each Award was $1000 US dollars. The first five winning students were selected from among the papers submitted to the General Assembly in Chicago.

Electromagnetic Theory Symposium, EMTS

EMTS is the Commission's international conference and is held every three years, in a country selected by the national Commission B Chairs, from among proposals submitted by the member countries. EMTS 2007 suppose to be held in Alexandria Egypt, which has a long history. Originally, it was suppose to be held in 2004. However, because of the security concerns, it was moved to Pisa, Italy, and Egypt was to hold the 2007 conference. Unfortunately, for the same reason, concerns were expressed by number of countries. Consequently, Egypt voluntarily declined to hold it in Alexandria on May 2006. This decision by Egyptian local Organizers threatened the cancellation of EMTS 2007.

As a last desperate attempt, invitations were sent out to all Commission B national committees to solicit their interest for holding the conference in their country. No interest was shown up until August 2006. At the time Commission B of Canada was preparing to organize the North American URSI conference in Ottawa. In late August Dr. Ross Stone suggested to us to consider joining the two conferences and holding them together in Ottawa, as the infrastructure was already in place. His suggestion was put to international vote, on a "Yes or No" basis. The decision of international committees was to go ahead and hold EMTS 2007 in Ottawa. In late October however, Japan showed interest in holding EMTS jointly with ISAP 2007 in Niigata. Since I was from Canada and the earlier decision was to hold EMTS in Canada, I felt obligated to overturn that decision and give Japan a chance to put their request to a vote. As a result, I stepped aside and requested Dr. Karl Langenberg, the Vice Chair of the Commission to take a new vote from the international Commission B Chairs, between Japan and Canada. Their decision was received by Dr. Langenberg and again was for Canada, which became final in November 2006. Thus, upon receiving the voting results, the preparation started in full speed to hold EMTS 2007 in Ottawa on July 26 - 29, 2007.

The preparation for organizing EMTS 2007 in Ottawa commenced in early December 2006, a mere eight (8) months before the conference. Not having much time, the organizing committees of North American URSI conference were integrated with those of EMTS, to have a full conference infrastructure in place in early December 2006. Then, a solicitation was made from all international colleagues to organize sessions in main interest areas of EMTS. The response was outstanding, and by early 2007 a Call For Papers was sent out and 21 organized sessions were put in place. This guaranteed at least about 200 papers for the conference. Unfortunately, we had only three months to receive the submitted papers. As a result, the total number of accepted papers for the conference, after the paper reviews, reached only to 241. Consequently, nearly the entire conference was due to the organized sessions. We are truly indebted to our international colleagues for their extraordinary efforts, in such a short time, to solicit papers and organizing their oral sessions.

The final statistics of EMTS 2007 was as follows

- Total accepted papers 241
- Total registrants 258
- Total full registrants 202
- Total students registrants 56
- Total Young Scientists 24

The conference supported financially 24 Young Scientists. The initial support came from the Commission budget of 9,000 Euros. The remaining amount was paid from the conference income. All in all, the conference was successful, and we received significant number of comments from Young Scientists and other participants on the quality of papers, scientific discussions, and the caliber of senior scientists attending the conference.

North American URSI Conference

Commission B also organized a joint North American conference of Canadian and US national committees, on July 22 – 26, 2007, in Ottawa Canada. This was a major undertaking for the Commission, and in effect saved the EMTS 2007. The final statistics of this conference was.

- 684 Abstracts
- 630 Total registrants
- 430 Full registrants
- 200 Students registrants

The two conferences overlapped by one day on July 26, and provided an excellent opportunity for the students and Young Scientists from around the world to meet together, as well as with the senior scientists of all URSI Commissions. It was a truly outstanding experience for the students.

General Assembly in Chicago

The format used for this conference was similar to the other two. Senior colleagues from around the world were invited to select the session of their choice and organize them with invited papers. As a result, all oral sessions of Commission B were fully complete before January 2008. This meant, all submitted papers had to be placed in the poster session. All in all, we have 310 accepted papers, to be presented in the General Assembly in Chicago. We are grateful for our colleagues for accepting the task of organizing the oral sessions and reviewing the submitted papers. Commission B also proposed successfully a General Lecture by Dr. S. Hagness, and a tutorial lecture by Dr. Eleftheriades. The details of Commission B program in GA 08 is provided at the end of this document.

Commission B Student Paper Prizes

To encourage the young generations of students to attend the URSI conferences and participate in its scientific activities, Commission B, in spring of 2008, established five (5) "Students Best Paper Prizes", each valued at 1000 US dollars. The funds came from the $5,000 extra budget URSI allocated to each Commission. Commission B believes that this is a positive way of encouraging students to excel in their research and the affairs of the URSI Commission B. We hope this tradition to continue in the future General Assemblies, by up coming Commission Chairs. The winning students will receive a certificate of Best Paper Prize at the first business meeting of Commission B, during the General Assembly in Chicago. The winning students in order of their paper number are:

Christian Sohl	for paper #1162
Yvonne Weitsch	for paper #1651
Thomas H. Hand	for paper #1856
Jurgen De Zaeytijd	for paper #2415
Taeyoung Yang	for paper #2769

The full title, authors, and affiliations of these winning papers, again in order of the paper number, are:

Paper #1162, "SOME PARADOXES ASSOCIATED WITH A RECENT SUMMATION RULE IN SCATTERING THEORY" by C. Sohl, M. Gustafsson, A. Bernland, Lund University, Lund, Sweden.

Paper #1651, "A NON-RADIATING COMPOSITE RIGHT-/LEFT-HANDED TRANSMISSION LINE DERIVED FROM SUBSTRATE INTEGRATED RECTANGULAR HOLLOW WAVEGUIDE" by Y. Weitsch, T. F. Eibert, Universität Stuttgart, Stuttgart, Germany.

Paper #1856, "CONTROLLABLE MAGNETIC METAMATERIAL USING DIGITALLY ADDRESSABLE SPLIT-RING RESONATORS" by T. H. Hand, S. A. Cummer, Duke University, United States.

Paper #2415, "THREE-DIMENSIONAL LINEAR SAMPLING APPLIED TO MICROWAVE BREAST IMAGING" by J. G. De Zaeytijd, C. L. Conmeaux, A. Franchois, Ghent University, Ghent, Belgium.

Paper #2769, "THE DESIGN OF ULTRA-WIDEBAND ANTENNAS WITH PERFORMANCE CLOSE TO THE FUNDAMENTAL LIMIT" by T. Yang, W. A. Davis, W. L. Stutzman, Virginia Tech, United States

Selection of New Vice Chair

The call for nomination of the new Vice-Chair of the Commission was sent out early in December 2007. It was repeated again twice, one in mid January and another in mid February. As a result, by the deadline of March 1, 2008, three excellent colleagues were nominated. The nominations were forwarded to URSI, immediately after the closing date of nomination. The call for the vote has been sent out twice more, after the first announcement by URSI. The interest in voting has been strong, which will be finalized after the final vote, during the first business meeting of the Commission, at the General Assembly in Chicago.

Selection of Symposium Site for EMTS 2013

The first call for proposals to organize EMTS 2013 was sent out in early December 2007. It was repeated again twice in January and March 2008. By the deadline, two excellent proposals were received. Immediately after the deadline, the proposals were circulated among the national Commission B chairs for voting. The request for vote has been repeated twice more, since then. The voting interest has been light. The final vote will be taken during the first business meeting of the Commission, at the General Assembly in Chicago.

Young Scientist Selection Criteria

In total 27 papers were submitted by 26 applicants from, Canada, Egypt, Finland, Germany, India, Israel, Korea, Singapore, Sweden, Switzerland, Taiwan, Ukraine and USA. All 27 papers were subjected to multiple reviews by Commission B Chairs, and members of Commission B from Canada, Finland, Germany, Ireland, Hungary, Switzerland and Taiwan. The Vice-Chair of Commission B, Dr. Karl Langenberg, was the chair of the Selection Committee. The foremost criterion for the selection was the excellence of the submitted papers, but formal aspects had also to be considered (age, completeness of the submitted material and so on). Finally, 24 applicants were chosen as recipients for a Young Scientist Award. All Young Scientists received a certificate and complementary Conference registration. However, only 19 received Financial support for travel, accommodation and

expenses. The following Table shows the list of winning Young Scientists.

EMTS 2007 Young Scientists

Euler	Timo	Technische Universität Darmstadt, Germany	Funding
Gupta	Shulabh	École Polytechnique de Montréal, Canada	Funding
Hadad	Yakir	Ben Gurion University, Israel	Funding
Ismatullah		Universität Stuttgart, Germany	Funding
Jylha	Liisi	Helsinki University of Technology, Finland	Funding
Perruisseau-Carrier	Julien	École Polytechnique Fédérale de Lausanne (EPFL), Switzerland	Funding
Sohl	Christian	Lund University, Sweden	Funding
Winebrand	Emil	Tel Aviv University, Israel	Funding
Alù	Andrea	University of Pennsylvania, USA	Funding
Lin	Yo-Shen	National Central University, Taiwan R.O.C.	Funding
Lomakin	Vitaliy	University of California, USA	Funding
Mahanfar	Alireza	Simon Fraser University, Canada	Funding
Ng Mou Kehn	Malcolm	University of Manitoba, Canada	Funding
Oh	Soon-Soo	ETRI, Korea	Funding
Yang	Songnan	University of Tennessee, USA	Funding
Yang	Fan	University of Mississippi, USA	Funding
Shramkova	Oksana	National Academy of Sciences of Ukraine, Ukraine	Funding
Eshrah	Islam	Cairo University, Egypt	Funding
Kumar	Dheeraj	Agra College, India	Funding
Alitalo	Pekka	Helsinki University of Technology, Finland	Certificate
Foroozesh	Alireza	University of Manitoba, Canada	Certificate
Hossain	Iftekhar	University of Manitoba, Canada	Certificate
Latif	Saeed	University of Manitoba, Canada	Certificate
Tzoulis	Andreas	FGAN-FHR, Germany	Certificate

Emerging Issues in URSI Commission B

Based on Consultation with National Committees the following are felt to be the most important emerging issues.

*A – **Administrative***

There are five issues of concern.

A1 – Equal voting weights.

At present, important decisions are made by consultation with the membership, a true democratic way. Two examples are the selection of Vice-Chairs and selection of EMTS conference sites proposed by member countries. The difficulty is that a good number of member countries never attend meetings or conferences and do not make any contribution to the Commission activities. However, they participate in voting, which cause serious difficulties in arriving at meaningful decisions, as they are not familiar with the dynamics of the commission and its scientific activities. Commission B requested the

Board to initiate discussions and dialogues on this topic. This will provide an opportunity for exchange of ideas with other Commissions and URSI senior administration. The result could be an improvement over the current practice.

A2 – National committee Chairs living in other countries.

A number of national commission Chairs live in other countries. For instance, in Commission B the Chair from New Zealand has moved to Canada a number of years ago and is a professor at Simon Fraser University in Vancouver. Yet, he still represents New Zealand. Obviously this gives Canada effectively two votes in any voting, and no vote for New Zealand. Another example is, the Commission Chair from Russia. He was in Turkey for a number of years, and for the last couple of years he resides in Sweden, again giving these counties two votes and no vote for Russia. These are only two examples, but there are others. As a result, major countries like Russia and China are not represented in URSI. Some discussion is needed to find a solution to this problem.

A3 – Potential new countries.

During my term, I came to know that some countries, like Singapore, Vietnam, Iran and a few others, currently are not a member, but their scientific community hope to be one. But, the lake of URSI visibility causes problems, as initiatives by interested colleagues are not taken seriously in their countries. Some type of formal process is needed to expand the URSI activities to such emerging counties.

A4 – Young Scientist Support.

The future strength of Commissions depends on their young scientists. For this reason, Commission B spends its entire budget for support of Young Scientists, to attend its international conference “Electromagnetic Theory Symposium, EMTS”. Last year, Commission B supplemented the Commission B budget from the conference revenue and managed to support 24 Young Scientists. The National organizations should be encouraged to further supplement the commission budget and help young scientists to attend URSI international conferences. Can URSI help in this area?

A5 – Commission and URSI visibility

One problem for attracting young generation to URSI sponsored research is the low visibility of URSI, as compared to IEEE. To improve the situation the Commission websites should be improved and the conference publications to be placed on the Commission websites. Last year, Commission B initiated this step and the scientific program and entire “Electromagnetic Theory Symposium, EMTS” conference publications were placed in its website. The Commission website is currently being expanded to include other areas of importance to Commission B.

B – Scientific

The electromagnetic science has been experiencing some sort of Renaissance in recent years, and thus, a few issues have emerged.

B1 – New scientific research areas.

New research areas, like metamaterials and NanoElectromagnetics, have emerged as a result of innovative thinking. These areas have common research interests in Physics and physical chemistry. Significant benefit can arise from collaboration or formal research contacts with these disciplines, and the methodology for establishing such contacts should be explored. Unfortunately, such out-reach activities are difficult to establish, as the research cultures are different, and the regulations of the funding agencies do not encourage them. URSI can play a useful role in this area.

B2 – New applied research areas

Other new but applied research areas are in Sensor Technology like RFID, sensors for Structural Health Monitoring, Medical Applications and remote Sensing. The emergence of NanoTechnology has dramatically changed the sensor technology, and thus, the electromagnetics. Strengthening the collaboration with other Commissions, as well as the related science areas like physics and chemistry, has become a necessity.

B3 – Microwave and millimeter wave imaging

The emergence of new requirements like low cost or high performance imaging systems in medicine, and safety and security issues have encouraged increasing research activities in inverse electromagnetism. This area has increasing need for growing collaboration with colleagues in mathematical science areas. Currently, establishing formal collaboration experiences problems similar to Applied Research areas, indicated in B2.

Commission B Scientific Program at General Assembly, GA 2008

*1- **Oral Sessions***

B01 - Electromagnetic theory, 11 papers (ICP)
Tuesday AM
Convenors: Gerhard Kristensson, Lund Technical University, Sweden, gerhard.kristensson@es.lth.se
Ben Zion Steinberg, Tel-Aviv University, Israel, steinber@eng.tau.ac.il

Summary

This session focuses on the fundamental aspects of electromagnetic theory in a broad sense. It includes new solution methods and approaches for problems in electromagnetics, as well as other theoretical aspects of electromagnetic theory. Advances in mathematical methods, solutions to canonical problems and electromagnetism in micro-and nano-technologies are of interest. Optimization and design for EM applications, as well as, mathematical modeling of nonlinear phenomena, EM problems of complex

and nonlinear materials and new approaches for solving wave propagation problems in these materials are especially welcome.

B02 - Scattering and diffraction, 10 Papers (ICP)
Wednesday PM
Convenors: Ludger Klinkenbusch, Technical University of Kiel, Germany, lbk@tf.uni-kiel.de
Guiliano Manara, University of Piza, Italy, d6951@ing.unipi.it
Summary
The session will review topics covering a wide range of scattering and diffraction problems, including edge diffraction, high frequency methods, hybridization with high frequency methods, use of artificial structures for optimal control of wave propagation, scattering from disordered media and potential applications. Study of scattering from non-linear/anisotropic media as well as mathematical problems will also be emphasized.

B03 - Inverse scattering, 7 Papers (ICP)
Monday PM
Convenors: Edwin Marengo, North Eastern University, USA, emarengo@ECE.NEU.EDU
Qing H. Liu, Duke University, USA, qhliu@ ee.duke.edu
Summary
This session covers contributions that detail new advances in the wave inverse theory, its methods and applications. This includes the development of efficient and rapid algorithms for solving linear and nonlinear inverse scattering problems in areas such as geophysical probing, remote sensing, non-destructive testing, medical imaging, target identification, etc. Radio frequency, microwave tomography and applications, iterative nonlinear inverse scattering techniques and electromagnetic techniques for nondestructive testing and evaluation are also of interest.

B04 - Antennas and arrays, 10 Papers ICP)
Friday PM
Convenors: Hisamatsu Nakano, Hosei University, Japan, nakano@k.hosei.ac.jp
Richard W. Ziolkowski, University of Arizona, USA, ziolkows@ece.arizona.edu
Summary
This session will concentrate on methods for the design, analysis and synthesis of antennas and arrays with a particular emphasis on electromagnetics aspects. It will include wideband and multiband elements and arrays, novel and exotic materials as well as material modifications for antenna performance enhancements, miniaturization methods and asssociated issues relating to bandwidth and efficiency, applications of formal antenna shape and volume design optimization methods and related algorithms, large finite arrays and associated fast methods, reconfigurable antennas and arrays, and coupling among antenna elements and large arrays/subarrays, interaction and coupling effects with the environment, numerical and hybrid methods, conformal antennas and antennas in layered media, antennas for space-based applications, efficient design methods for arrays and associated feed networks, fabrication and integration aspects of antennas and arrays, including material development processes.

B05 - Numerical, asymptotic and hybrid methods, 7 Papers (ICP)
Friday AM
Convenors: Vincenzo Galdi, University of Sannio, Italy, vgaldi@unisannio.it
Makoto Ando, Tokyo Institute of Technology, Japan, mando@antenna.ee.titech.ac.jp
Summary
This session will address the developments in the construction of integral and differential equation methods, as well as, hybrid and asymptotic techniques for efficient solution of radiation and scattering problems. Special interest will be also on solvers for large problems, and application of model based parameter estimation techniques to speed up field computations in time and frequency domains.

B06 - Transient fields and ultra wide band antennas, 7 Papers (ICP)
Saturday AM
Convenors: Ehud Heyman, Tel Aviv University, Israel, heyman@eng.tau.ac.il
Filippo Capolino, University of Siena, Italy, capolino@dii.unisi.it
Summary
True time domain radiation and reception has become important in applications ranging from impulse radar to ultra wideband radio to electronic warfare. This session will explore the theory that relates these varied applications and the systems that have been built to realize true pulsed radiation. Invited presentations will cover transient radiation and propagation theory and the relationship to frequency domain theory; methods and hardware for true time domain measurements; antennas and systems for UWB radio; impulse radar, target ID, and ground penetrating radar; and timed/UWB arrays, UWB SAR, and time reversal imaging. Papers are encouraged that explore true transient radiation physics, not just time domain numerical modeling

B07 – Wave Field Imaging for Homeland Security, 7 Papers (ICP)
Monday AM
Convenor: Karl Langenberg, University of Kassel, Germany, langenberg@uni-kassel.de
Juergen Detlefsen, Technical University Munich, Germany, detlefsen@tum.de
Summary
"Homeland Security" covers all aspects of scientific and engineering, which may contribute to ensuring the safety and security of persons on a public environment. As such, wave fields in a general sense; acoustic, elastic and electromagnetic waves in every frequency regime; can be relevant to the development of imaging systems to screen persons for concealed objects, to scan buildings to assess their integrity, to monitor the aging of materials non-destructively. Therefore, papers from rather distant disciplines are solicited in order to exchange ideas and to recognize common approaches.

BCD - Physical Limitations of Electromagnetic Metamaterials, 8 Papers (ICP)
Wednesday AM
Convenors: Ari Sihvola,TKK Electromagnetics Laboratory, Finland, ari.sihvola@tkk.fi
Arthur Yaghjian, Hanscom AFB, USA, a.yaghjian@verizon.net
Christophe Caloz, École Ploytechnique, Canada, christophe.caloz@polymtl.ca
Summary
This session shall focus on the limitations and restrictions that basic principles of physics and engineering practicalities place upon the development of electromagnetic materials and their applications. Recent research on the design and use of various metamaterials has created a large amount of theoretical studies on the behavior and use of materials with unconventional material parameters such as negative permittivity and permeability or large anisotropies. On the other hand, fundamental principles such as causality, energy, and dispersion relationships as well as practical considerations such as losses, tolerances, and bandwidth may preclude the existence or practical realization of certain metamaterials and their applications. In this session, these limits will be charted.

BCK – Body Area Networks, including medical Application, 6 Papers (ICP)
Tuesday PM
Convenors: Yahya Rahmat-Samii, UCLA, USA, rahmat@ee.ucla.edu
Koichi Ito, Chiba University, Japan, ito.koichi@faculty.chiba-u.jp

Summary
Wireless systems, especially mobiles, require antennas with system-dependent requirements. They include operation near the human body, operation in a multi-path environment, extremely small size, space, beam and polarization diversity, dual-frequency operation, pattern reconfiguration, smart antennas and adaptive techniques. Unique quality factors, in contrast to the classical ones, are also introduced such as mean effective gain, correlation factor and efficiency in terms of volume, design techniques for antennas featured for mobile wireless systems, implementation of new concepts, cost-effective realization of antennas and field-test results are of special interest. Introduction of latest projects such as ACE are introduced.

BK - Future Challenges of Computational Electromagnetics, 11 Papers (ICP)
Thursday AM
Convenors: Tapan Sarkar, University of Syracuse, USA, tksarkar@syr.edu
Magdalena Salazar Palma, salazar@tsc.uc3m.es
Summary
In the future the processors will be multicore. In addition the clock speeds are changing rapidly. They will have a tremendous impact on the computational electromagnetics. The objectives of this session are surveying the state of the art in computational electromagnetics and understanding what the future will bring.

BKF- Stochastic modeling and uncertainty management in electromagnetics, 6 Papers (ICP)
Thursday PM
Convenors: Wong Man-Fai, France Telecom, France, manfai.wong@orange-ftgroup.com
Joe Wiart, France Telecom, France, joe.wiart@orange-ftgroup.com
Summary
While electromagnetic modeling has made great progress, known deterministic data imply very accurate analyses. A great challenge of electromagnetic modeling is to take into account stochastic processes (random media) or to manage uncertainties (lack of knowledge). Classical Monte-Carlo methods are unpractical in real life applications, thus specific techniques are needed.

2 - Poster Sessions

David Jackson, University Houston, USA, David.Jackson@mail.uh.edu
Aldo Petosa, Communications Research Centre, Canada, aldo.petosa@crc.ca
Summary
Contributed papers related to the terms of reference of the Commission

3 - TUTORIAL B

Transmission-Line Metamaterials: Fundamentals and Applications
Speaker: George Eleftheriades, University of Toronto, Canada, gelefth@waves.utoronto.ca

4 - General Lecture

Microwave Imaging in Medicine, Promises and Future Challenges
Speaker: Susan Hagness, University of Wisconsin-Madison, USA, hagness@ece.wisc.edu