XVth International Seminar/Workshop DIPED-2010

The XVth International Seminar/Workshop on Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory (DIPED-2010) has been organized by the IEEE MTT/ED/AP/CPMT/SSC West Ukraine and MTT/ED/AP Georgian Chapters. This year, the event was held at the Tbilisi State University, Tbilisi, Georgia, on September 27-30.

The DIPED-2010 Seminar/Workshop celebrated the 15th anniversary and was dedicated to 70th anniversary of Prof. Nikolai N. Voitovich who is permanent Organizing Committee Co-Chairman since 1995. Until 1990, DIPED was held annually in Lviv and Tbilisi at a turn and it assembled the scientists and engineers from various cities of FSU (Moscow, Tbilisi, Lviv, Kharkiv, Chelyabinsk, Novosibirsk, Saint Petersburg, etc.), as well as from the neighboring countries. The atmosphere of these meetings was characterized by the scientific adherence to principle and uncompromisingness; the novel ideas were discussed and checked by the joint cooperation; the young scientists freely contacted with their more experienced older colleagues and felt themselves comfortable in their company; the humor and good-neighborhood prevailed in relations.

Figure 1. The warm welcome from Prof. Revaz S. Zaridze, DIPED-2010 Seminar/Workshop Chairman

At the beginning of 90s the work of the DIPED was temporary interrupted from the non-scientific reasons. At the same time, thanks to efforts of Prof. Voitovich, the IEEE West Ukraine Joint Chapter was established. It was the first IEEE Chapter in Ukraine and one of the first in the FSU countries. The cooperation with the IEEE enabled to renew the DIPED and reconstruct it in the annual joint Seminar/Workshop of both the MTT/ED/AP/CPMT/SSC West Ukraine and MTT/ED/AP/EMC Georgian Chapters. The DIPED obtained such status in 1995. The successful holding all DIPEDs in many aspects indebts to Prof. Voitovich, his enthusiasms, organization efforts, and permanent care.

The IEEE Antennas & Propagation, Microwave Theory & Techniques, and Electron Devices Societies provided the technical co-sponsorship for the DIPED-2010. The Solid State Circuits Society and Section Ukraine were the supporting IEEE institutions.

Prof. Revaz S. Zaridze, Co-Chairman of the Local Organizing Committee, and Dr. Tamar Gogua, Secretary of the Local Organizing Committee bended every efforts for general and local organization of the event.

The DIPED-2010 technical program consisted of 42 papers including 4 invited talks. The scientists from China, Georgia, India, Israel, Japan, Poland, Russia, USA, and Ukraine presented their papers. The papers were arranged at the following sections:

- Theoretical Aspects of Electrodynamics
- Diffraction and Scattering
- Modeling, Analytical and Numerical Methods
- Propagation in Complex Media
- Waveguide, Layered, and Cable Structures
- Antennas and Arrays
- Acoustics

After the opening ceremony, the plenary session was started by online presentation of Prof. Nikolai N. Voitovich (Lviv, Ukraine), devoted to the analytical-numerical methods of solving the synthesis problem according to the prescribed amplitude directivity pattern for the various types of antennas and arrays. The novel results regarding obtaining the analytical solutions for the respective nonlinear Euler equations were presented. Report stimulated the active online discussion of attendees and distant auditory.

One more online presentation of Prof. Boris Z. Katsenelenbaum (Naharia, Israel) concerned to the diffraction on a hole in rotating screen. In such system, a diffraction image arises on the receiving plane located in the Fresnel zone in parallel to the screen. If the screen rotates in its plane, then the image does as well. The question was discussed what is distribution of the field energy on the receiving plane averaged over the period.

Prof. Tamaz Vashakmadze (Tbilisi, Georgia) reported in his presentation about the nonlinear dynamical processes for some piezo-electric and electrically conductive continuum media. It was presented an union form of three-dimensional (respect to spatial coordinates) nonlinear dynamical systems of partial differential equations (PDEs) which contains as particular cases Navier-Stokes' equations

and Maxwell's equation system while in continuum media the electro-magnetic fields become exited. Some specific nonlinear wave processes for elastic piezo-electric and electrically conductive anisotropic elastic thin-walled structures were discussed.

Figure 2. Prof. T. Vashakmadze presenting the plenary talk concerns the nonlinear dynamical processes

Dr. Mikhail Prishvin (Tbilisi, Georgia) presented the joint report of authors from Georgia and USA, about the improved numerical simulation and analysis of thermal response during electromagnetic (EM) exposure with FDTDLab. The recent results concerns the influence of EM exposure of mobile phones radiation on a human were presented.

Figure 3. Dr. M. Prishvin describing the novel results on mobile phones radiation

It was shown, that presence and position of the hand (which is actually required in order to use the phone) substantially can change users head exposure and radiation pattern, and during analysis exposure we could consider another parameters of the antenna's position.

The most interesting topics at the regular sessions were the diffraction and scattering in waveguide, layered and cable structures, propagation in complex media, and antenna theory and techniques.

The presentation "Comparative Study of the Differential Phase Shift in Some Circular Waveguides, Containing Azimuthally Magnetized Ferrite" reported by Prof. Georgi N. Georgiev (Veliko Tirnovo, Bulgaria) stimilated a long time post-presentation discussion. In particular, the topics related to the differential phase shift, formed by two circular waveguides, were discussed. The discussion was stimulated by the novel construction of the considering transmitting line, in which the first waveguide is entirely and the second one is partially filled with remanent ferrite of azimuthal magnetization. In the second part of transmission line the anisotropic load is of the shape of a toroid which takes up its outer area only, while it's interior is occupied by dielectric. The fact that the phase shift might be produced in wide frequency band opens a way for application of such lines in many electrodynamic systems.

Figure 4. Active discussion after the presentation of Prof. G. Georgiev (at left) and Prof. D. Karkashadze (at right)

Prof. Kiyotoshi Yasumoto (Kyushu, Japan) made the presentation related to scattering from a finite periodic array of magnetized ferrite rods.

Figure 5. Prof. S. Prosvirnin commenting some results of Prof. K. Yasumoto's presentation

The semi-analytical approach for investigation of scattering effects on such array consists in extracting the reflection and transmission matrices of a cylindrical periodic layer and then obtaining the characteristics of layered structures by using a recursive formula. The approach allows to consider different types of circular rods and different types of excitation sources. The numerous questions and discussion after presentation demonstrated the high urgency of presented topic.

The most interesting in antenna topics was presentation "To the Theory of Electromagnetic Horn Antenna" made by Prof. Guram Sh. Kevanishviki (Tbilisi, Georgia). Aspects of creation of correct electrodynamic theory of horn antennas were suggested. Due to the definite purposes the correct (adequate) electrodynamic theory of horn antennas doesn't exist up to present days in the scientific literature. This fact was demonstrated on the example of E-wave sector horn. It is shown how should be overcome the mathematical difficulties existing now in this direction.

Figure 6. Prof. G. Kevanishvili discussing on the correct electrodynamic theory of horn antennas

Fig. 7. Prof. E. Gevorkyan talking about the EM wave propagation in the absorbing plate in a waveguide

The presentation of Prof. Eduard Gevorkyan (Moscow, Russia) was devoted to propagation of transverse-magnetic (TM) waves in the absorbing plate in a waveguide. Fresnel formulas and analytical expressions for the power reflection, transmission and transmission interference coefficients are obtained for the case of arbitrary waveguide cross section. The various aspects of interaction of two TM waves with different initial phases in a plane-parallel plate in unlimited space were investigated and numerically studied.

The DIPED Organizing Committee traditionally pays a significant attention to the professional development of the young scientists and PhD. students. Providing the special travel grants and awarding prizes for the best papers and presentations are the ways to recognize their contribution into work of the DIPED.

This year, the following young participants were granted by the Best Young Speaker Award:

- Dr. Mikhail Prishvin (Tbilisi State University, Tbilisi. Georgia) for "Improved numerical simulation and analysis of thermal response during EM exposure with FDTD Lab".
- Mr. Ivan Petoev (Tbilisi State University, Tbilisi. Georgia) for "The electromagnetic properties of periodic structures".
- Mr. George Chikovani (Tbilisi State University, Tbilisi. Georgia) for "Scattering of low frequency magnetic fields by thin 3D sheets with combined resistive and magnetic properties",
- Mrs. Elena Yavolovskaya (EMCoS Laboratory, Tbilisi, Georgia) for "Effective computational techniques for EMC analysis of cable harness".

Figure 8. Mrs. E. Yavolovskaya presenting the paper recognized by the Best Young Speaker Award

Traditional Seminar/Workshop dinner was held after completion of the technical program. The Best Young Speaker Awards were presented there as well as the discussions about the improvement of the

Seminar/Workshop format and proposals for future participants were made. The original Georgian dishes and splendid drinks contributed to the intimate atmosphere of friendship between the participants and guests.

Figure 9. The memory photo after DIPED-2010 Closing Ceremony

Figure 10. Mrs. Lali Bibilashvili (on right), Organizing Committee member, serving to the Best Young Speaker Award recipients: PhD. student I. Petoev and Dr. M. Prishvin (from left to right)

The social events included the excursion to Sighnaghi town, situated on 90 km of Tbilisi. It is a town in Georgia's easternmost region of Kakheti. Sighnaghi is one of the country's smallest towns with a population of 2,146 as of the 2002 census. The town and its environs are also known for their landscapes and historical monuments. Sighnaghi has recently undergone a fundamental reconstruction program and has become an important centre of Georgia's tourist industry. The town is walled with the remnants of 18th-century fortifications.

There are two Georgian Orthodox churches in the town itself - one dedicated to St. George and the other to St. Stephen. The venerated Bodbe Monastery is located 2 kilometers from Sighnaghi and is a place of pilgrimage due to its association with St. Nino, the 4th-century apostle of Georgia. Participation in such very interesting excursion tour and acquainting with so nice architectural and nature ensembles was highly appreciated by the participants and brought to them a big portion of positive emotions.

Figure 11. The view of Sighnaghi town with Big Caucasus at the background

Figure 12. Dr. M. Andriychuk, Dr. V. Tabatadze, Dr. V. Tkachuk, and PhD. Student I. Petoev (from left to right) during the Bodbe monastery excursion

It was announced by the organizers that the next Seminar/Workshop DIPED will be held at the Institute of Applied Problems of Mechanics and Mathematics, Lviv, Ukraine, on September 26-29, 2011. The previous attendees and new participants are cordially invited.

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