XIXth International Seminar/Workshop DIPED-2014

The XIXth International Seminar/Workshop on Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory (DIPED-2014) was organized by the IEEE MTT/ED/AP Georgian and MTT/ED/AP/CPMT/SSC West Ukraine Chapters. This year, DIPED was held at the Tbilisi State University, Tbilisi, Georgia, on September 22-25. The Ivane Javakhishvili Tbilisi State University (TSU) and Pidstryhach Institute of Applied Problems in Mechanics and Mathematics, NASU, Ukraine, were the co-organizers of DIPED-2014. The IEEE Antennas and Propagation Society, Electron Devices Society, and Microwave Theory and Techniques Society provided the technical co-sponsorship for the seminar/workshop. The TSU provided the special financial support for the event that made it possible to extend the DIPED-2014 audience from outside Georgia (Figure 1). The IEEE Solid State Circuits Society and IEEE Ukraine Section were the supporting IEEE organizations.

Prof. Revaz S. Zaridze, Chair of the Local Organizing Committee, Dr. Tamar Gogua, IEEE MTT/ED/AP Georgian Chapter Secretary, and Dr. Giorgi Ghvedashvili, IEEE MTT/ED/AP Georgian Chapter Chair, made all efforts for the general and local organization of the event.

The DIPED-2014 technical program consisted of 44 papers, including five invited talks. Scientists from Georgia, Germany, Israel, Pakistan, Poland, Russia, South Korea, USA, and Ukraine brought forward their papers. The papers were arranged in the following sections:

- Theoretical Aspects of Electrodynamics
- Diffraction and Scattering
- Antenna Synthesis and Inverse Problems
- Novel Methods in Electrodynamics
- Antenna Design
- Analytical and Numerical Methods
- Acoustics and Remote Sensing

The plenary session started with a presentation by Prof. Alexander G. Ramm (Kansas State University, USA), devoted to the theory of wave scattering by small bodies (particles). In his presentation, the mathematical foundations of electromagnetic (EM) wave scattering theory for small impedance particles of an arbitrary shape were given. This problem was originated by Lord Rayleigh in 1871, who understood that the main term in the scattered field is the dipole radiation. He did not give formulas for calculating this radiation for small bodies of

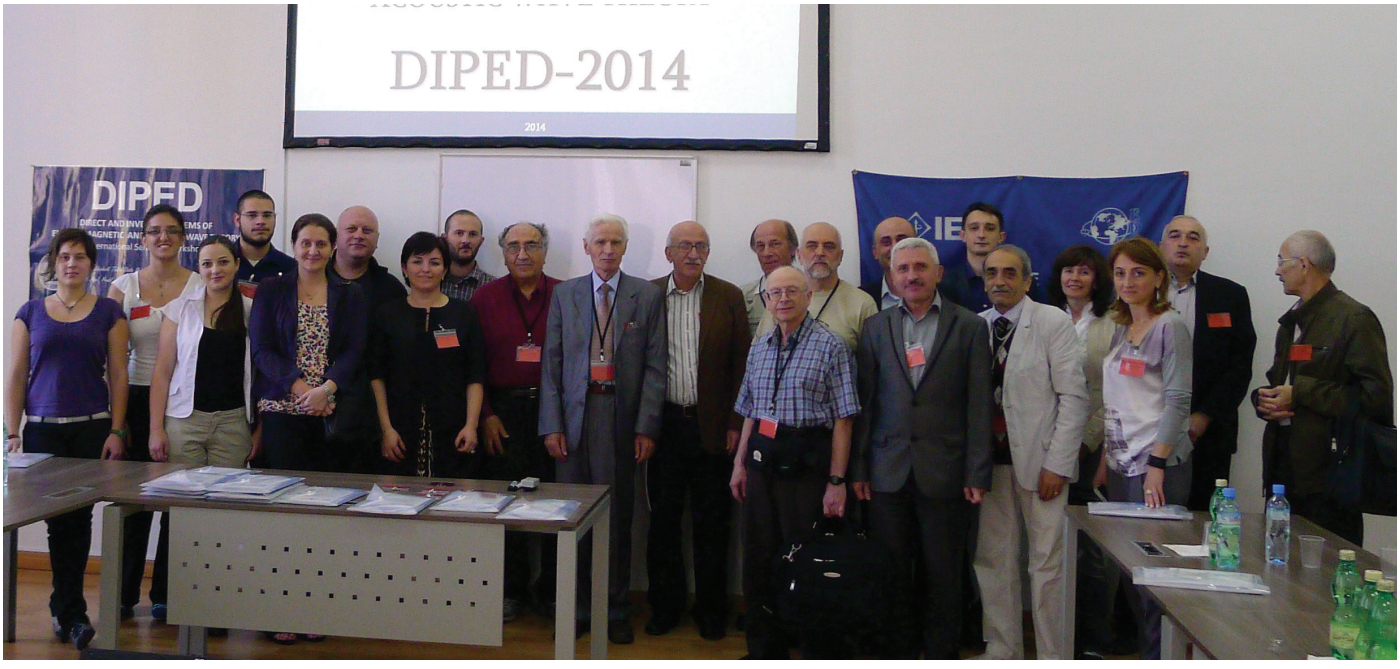

Figure 1. A group photo of the DIPED-2014 participants at the opening ceremony.

an arbitrary shape. This was done by the author in a series of previous publications. In particular, the theory was developed to include scalar wave scattering for various boundary conditions (the Dirichlet, Neumann, impedance, and interface boundary conditions); and the problem of EM wave scattering by many small bodies of arbitrary shapes was summarized. The report stimulated active discussion after the presentation, and prolonged debate in the lobby.

The next contribution, "Base Station Antenna's EM Field Distribution in the Room with a Human Model Inside," was given by Veriko Jeladze. The mobile communication system base station's radiation interaction with a human model inside of a building was presented. The inner field and its amplification by the building as a resonator were studied. The problem was solved using the Method of Auxiliary Sources with a program package created for numerical experiments. Several cases of the human's location and the building wall's transparency parameters were presented.

The presentation, "Comparing Different Approaches to Linear Antenna Synthesis Problems According to Power Radiation Pattern," given by Dr. Olena Bulatsyk, was devoted to the antenna synthesis problem, according to the prescribed power radiation pattern with the equality of the norm condition. The problem was solved by an approach based on the concept of generating polynomials. The variational formulation, supplied by the Lagrange method of multipliers, was applied for solving the problem. The modified Newton method was used for numerical solving of the respective integral-transcendental equation systems. The approach was numerically tested on the example of a linear-antenna synthesis problem, recently solved directly by the Newton method. Numerous computational results were presented, analyzed, and discussed.

This year, the traditional DIPED topics were extended by presentations related to antenna measurements, the application of micro and macro measurements of EM waves, the technology of production of carbon nanoparticles, as well as to the elaboration of tools for the search of non-metallic targets.

One more interesting presentation, devoted to the electromagnetic analysis of a cylindrical antenna with complex structure, was given by Prof. Guram Kevanishvili (Georgian Technical University, Tbilisi, Georgia). In his presentation, a specially constructed cylindrically shaped antenna's electromagnetic analysis was presented. Formulas for calculating the antenna's radiation characteristics were obtained, and a series of new physical phenomena were announced.

This year, the group of regular students, PhD students, and young scientists was present at the seminar/workshop in large quantities (Figure 5). The following young participants (Figure 6) were granted the Best Young Speaker Award:

- Ms. Veriko Jeladze (Tbilisi State University, Tbilisi, Georgia) for "Base Station Antenna's EM Field Distribution in the Room with a Human Model Inside"
- Dr. Olena Bulatsyk (Pidstryhach Institute of Applied Problem in Mechanics and Mathematics, Lviv, Ukraine) for "Comparing Different Approaches to Linear Antenna Synthesis Problems According to Power Radiation Pattern"
- Mr. Victor Lysechko (Physiko-Mechanical Institute, Lviv, Ukraine) for "Diffraction of the Sound Wave by a Finite Soft (Rigid) Cone"
- Mr. Giga Gabriadze (Tbilisi State University, Tbilisi, Georgia) for "Modified Edge Current Method for High Frequency Scattering Problems"
- Mr. Giorgi Jambazishvili (Tbilisi State University, Tbilisi, Georgia) for "Experimental Localization of a Dielectric Object Near a Two-Way Line"
- Mr. Kaka Lomia (Tbilisi State University, Tbilisi, Georgia) for "Bio Heat Equation Modeling on Macro and Micro Scales"

The recipients of the awards were recognized by a special certificate from the Program Committee and a financial grant from the Organizing Committee.

Following the DIPED tradition, time given up to the free lobby discussions took a considerable part of the total continuation of DIPED-2014.

The big excursion tour in the framework of the seminar/workshop social events consisted of three parts. The first of these was an excursion in Tbilisi, and acquainting attendees with the most interesting architectural sights (Figures 7-11). The next point was a visit to the Jvari church (Figures 10-11). The Jvari church, the church of the Holy Cross, is situated in Mtskheta, and stands on the rocky mountaintop at the confluence of the Mtkvari and Aragvi rivers. The beginning of Christianity in Georgia is closely connected to its history. After the conversion of Kartli, a large wooden cross was erected on the spot where the church was later constructed. The cross was able to work miracles and therefore drew pilgrims from all over the Caucasus. The Jvari church was built between 586 and 605 by Ersimtavari Stepanoz I, upon the cross that it enclosed within its interior.

A tour around Mtsheta, the oldest capital of Georgia, finished the excursion. Mtsheta is located within 30 km from Tbilisi. This beautiful, rare architectural ensemble of the 11th century is unique in its own way. Standing at the confluence of the Aragvi and Mtkvari rivers, one of the oldest towns in Georgia, Mtskheta has been populated since the second millennium B.C. It was the capital of the Eastern Georgian kingdom of Iberia from the third century B.C. It is thought that the name "Mtskheta" comes from the name for the "father of all Georgians, the son of Kartlos: Mtskhetos." Mtskheta is designated as a UNESCO World Heritage Site and is a living museum, with many architectural and historical monuments.

Figure 2. Prof. Alexander Ramm presenting the plenary invited talk about EM wave scattering on small impedance bodies.

Figure 3. Prof. Nikolai Voitovich (c) looks on at the active discussion between Prof. David Karkashadze (l) and Prof. Alexander Ramm (r) after his presentation.

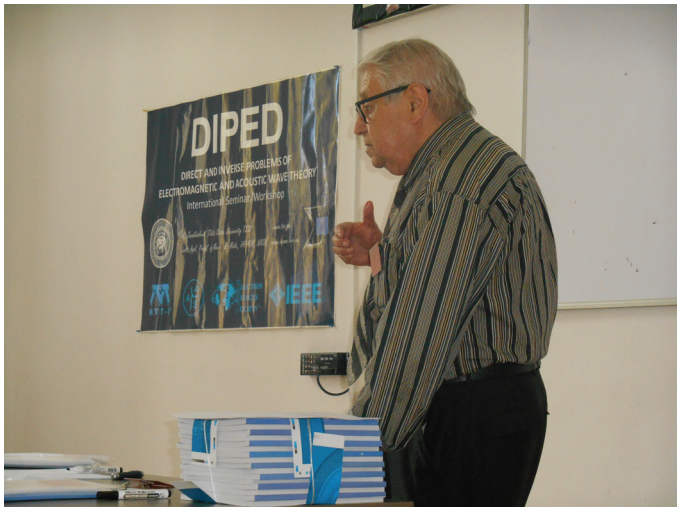

Figure 4. Prof. Guram Kevanishvili makes public new physical results related to a complex cylindrical antenna.

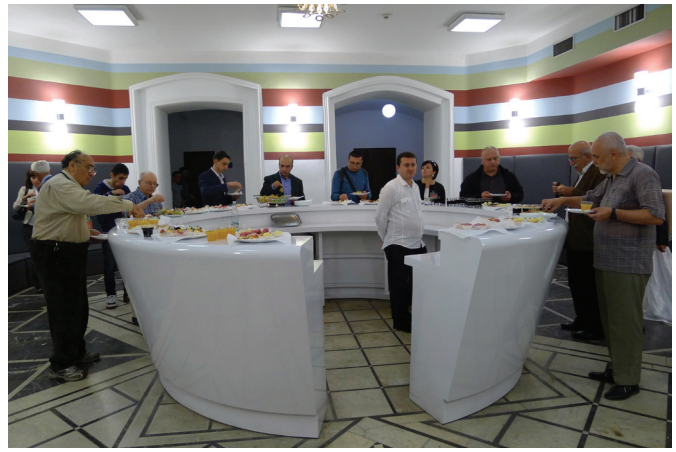

Figure 5. A coffee break for the DIPED-2014 participants.

Figure 6. The DIPED-2014 Young Speaker Award recipients: (l-r) Victor Lysechko, Kaka Lomia, Giga Gabriadze, Giorgi Jambazishvili, Veriko Jeladze, and Olena Bulatsyk.

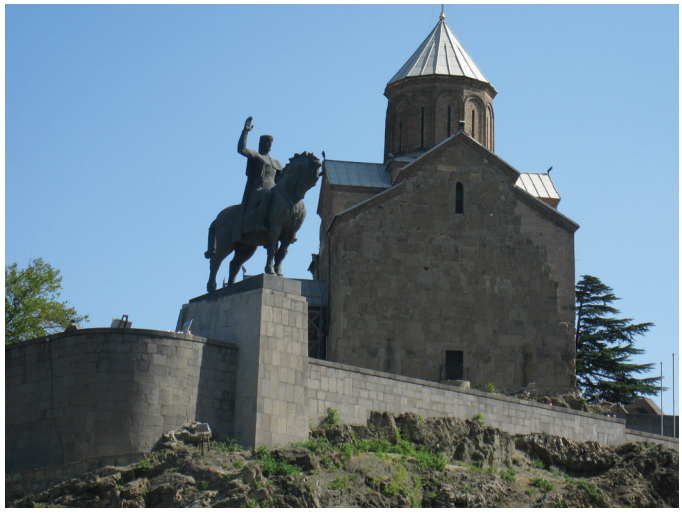

Figure 7. The monument of Vakhtang Gorgasali, Tbilisi founder, with the Metekhi Church in the background.

Figure 8. The monument of Taras Shevchenko, national Ukrainian poet, near the main TSU building.

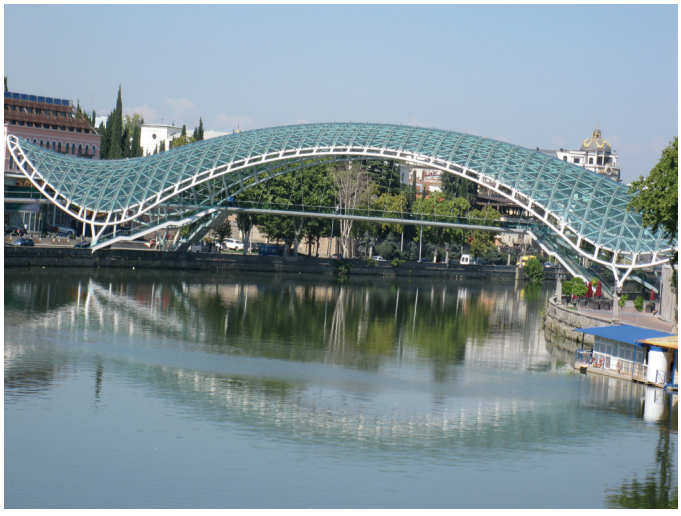

Figure 9. The new architecture of old Tbilisi: the bridge over the Mtkvari river.

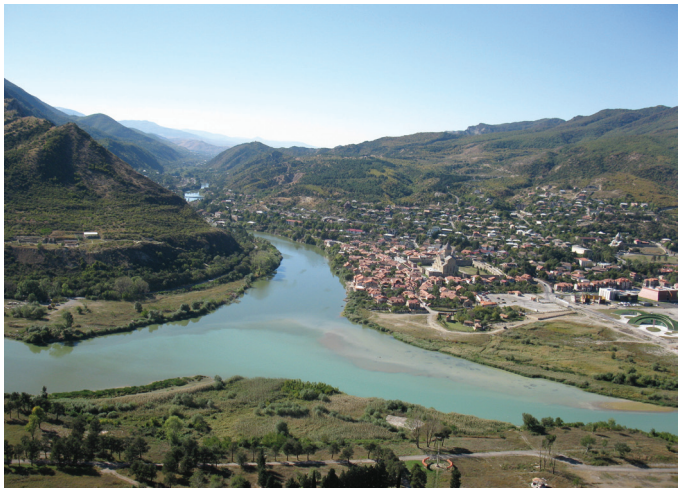

Figure 10. A nice view of the oldest capital of Georgia, Mtskheta, from the Jvari church high point.

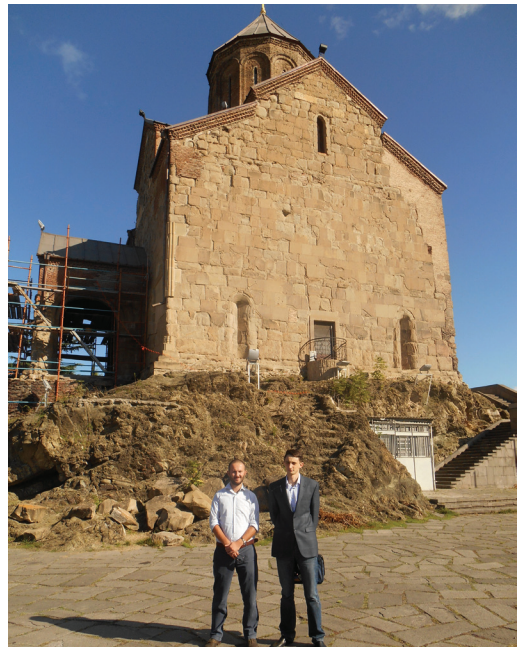

Figure 11. Kaka Lomia (l) and Victor Lysechko (r), with the Jvari church in the background.

Figure 12. Prof. Revaz Zaridze, DIPED-2014 Organizing Committee Chair (r), giving Mr. Victor Lysecko (l) the Best Young Speaker Award. Dr. Mykhaylo Andriychuk (c), Program Committee Secretary, assisted him.

Figure 13. Ms. Veriko Jeladze (l) was also given the Young Speaker Award.

A traditional seminar/workshop dinner was held after the completion of the technical program. The Best Young Scientist Awards were presented there (Figures 12, 13), as well as the discussions about the improvement of the seminar/workshop format, and proposals of the participants were taken into consideration. The original Georgian dishes and splendid drinks contributed to the intimate atmosphere of friendship among the participants and guests.

In our opinion, the DIPED-2014 seminar/workshop served the further restoration and intensification of the conventional cooperation among the scientific schools of the participating countries in diffraction theory and its application, widely presented in the program, as well as the expansion of existing contacts and spheres of scientific interests.

It was announced by the organizers that the next, 20th anniversary seminar/workshop DIPED will be held at the Institute of Applied Problems in Mechanics and Mathematics, Lviv, Ukraine, on September 21-24, 2015. The previous attendees and new participants are cordially invited.

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