



NEW TYPES OF PCS ANTENNAS AND PROGRAM PACKAGE FOR ANTENNA DESIGN

Description

The progress in Wireless Communications Systems (WCS), which has resulted in fast developing area of Personal Communications Systems (PCS), requires development of new PCS components and devices with improved characteristics to meet ever-increasing demands. The most complicated and critical parts of these systems are antennas due to the up-to-date severe and, sometimes, contradictory claims to their geometrical, electrical, directional and compatibility characteristics. Specifically, the antennas should be well matched with feeder and with free space, and also to possess the wide-band characteristics. At the same time, they are desired to be minimized in size, to be as diminutive as it is possible. Moreover, the antennas should satisfy the present-day claims to ecological and health safety conditions, and minimization of electromagnetic energy radiation. All is especially important for fabrication of portable PCS.

Experimental investigation of Antennas, for obtaining optimal geometrical and physical parameters of the desired model, is quite difficult and expensive work. Therefore, much favorable is computer simulation and fast numerical experiment of the suitable physical model of Antenna in order to find out the best shape and optimal parameters, which is nowadays generally adopted before experimental testing of prototypes and serial manufacture. Adequate choice of physical model gives a good agreement between computed and experimental results. Thus, creation and development of user-friendly computer program is much cheaper and allows full investigation of EM process in desired Antennas. For this purpose, an efficient numerical method for numerical simulation of such phenomena is highly demanded.

In Laboratory of Applied Electrodynamics (LAE) of TSU software package with a user-friendly interface for engineering application was developed to carry out numerical experiments. This software does not require of the user a deep knowledge of mathematical apparatus and the employed solution method. It helps the antenna designer simulate operation of future antennae in different environments and study their EM characteristics. The software package enables to investigate the proposed antenna structure excited by a coaxial cable and to study its radiation capabilities by changing its geometric and physical parameters. Package allows a study of the Interaction of the antenna field with the nearby located objects (especially with the human body) considering changing geometric and physical parameters of the latter. Main requirements and parameters of Program Package:

- Windows 98/2000/XP/
- Pentium II/300MHz
- 128 Mb RAM

Innovative Aspect and Main Advantages

The main innovation of above mentioned technology is an application of the original numerical method, namely the Method of Auxiliary Sources (MAS) developed for solution of complicated antenna and other diffraction problems. According to the MAS, the unknown scattered field in each particular region is represented as a superposition of the fields of Auxiliary Sources (AS) specially distributed in non-physical regions. The reason for such representation is the linear independence of fundamental solutions of appropriate wave equations proved by well-known Georgian mathematicians N.Muskhlishvili, I.Vekua, and V.Kupradze as early as in 1960th. The correct choice of the type and distribution of auxiliary sources, which is

the subject of theoretical and numerical analysis, provides the effective solution of the stated antenna problem as boundary electrostatics problem and calculation of desired antenna characteristics with required accuracy. Supposed Program Package has following advantages then existing analogues:

- Easy and Serviceable Interface;
- Possibility of parametric investigation;
- Method of modeling of Electrodynamic problems and error self-estimation;
- Possibility of investigation of different Antenna types;
- Possibility of investigation of Interaction of the antenna field with the nearby located objects;
- High speed of numerical experiments (5 - 15 min).

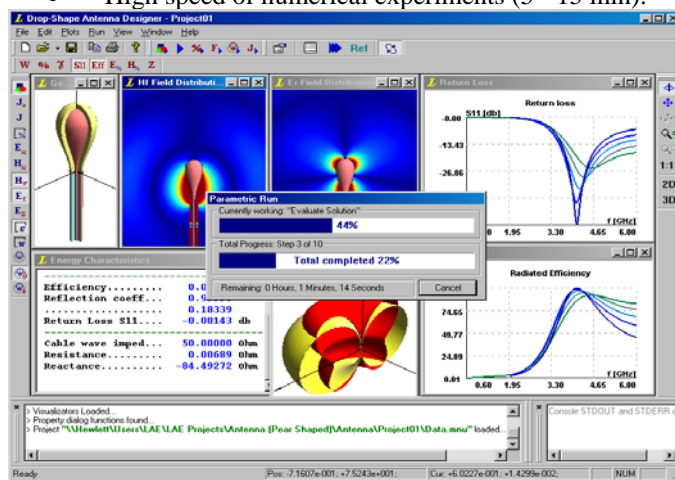


Fig. 1 Program Package "Antenna Designer".

Areas of Application

Most perspective is a WCS segment of today market, namely:

- Different portable device vendors (such as cell-phone manufacturers);
- Different Scientific Laboratories oriented on Antenna design and EMC/SAR problems;
- Package will serve for educational purposes in undergraduate and graduate level physics courses in TSU or any other world university, since students will study antenna problems by observations and measurements in a real time, which is also very important.

Stage of Development

Proposed Technology was tested. Several antenna prototypes with different sizes and shapes were fabricated and tested using our preliminary numerical investigations. Necessary experimental measurements have been performed at the Laboratory for Electromagnetic Fields and Microwave Electronics of Swiss Federal Institute Of Technology using network analyzer and anechoic chamber provided with equipment for measurement of antenna patterns. Comparison of obtained results to those from numerical experiments revealed good agreement between the two.

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