Military Technical Academy "Ferdinand I"

"Contributions to the study of sensor systems and antenna array with applications in information society technologies"

Author: Cașu George

The fast development of information society technologies, of their applications and networks that promise high transfer rates have led to major changes at all levels in terms of society and human activity and showed significant marketing potential.

Thus, the present paper highlights the interest in antennas, sensors, devices and beamforming techniques in the radio and acoustic field that are being used in various applications of modern communication networks.

Chapter 1 is about the general aspects in the field of the doctoral thesis, the purpose of the doctoral thesis and its content.

Chapter 2 reveals a variant for the implementation of an antenna and a microstrip patch antenna array. The microstrip antenna is built on a dielectric material, usually a PCB board and operates in the microwave frequency range (0.3-3 GHz).

Chapter 3 begins with an analysis of the conventional and adaptive beamforming techniques. The methods studied in the practical part of this chapter use a microphone array in order to perform spatial filtering from a certain direction.

Beamforming technique or the spatial filtering technique of the signals in a sensors array or antennas array determines the data transmission / reception way, bringing benefits to the quality of the communication channel such as: high SNR (high directional transmission improves the quality of the connection and increases the communication distance, both in open and closed environment), the rejection and prevention of interference and fading (beamforming suppresses interference between channels by using the spatial properties of the antennas) and high spectral efficiency of the network (by minimizing the interference between channels the multiple MIMO antenna systems can be used together with higher order modulations - 24 QAM, 64 QAM, which improve the total capacity of the communication channel).

Chapter 4 describes the fading phenomenon and its influence over the performance of radio communication systems. It also analyzes how different types of fading (AWGN, Rayleigh, Rician) affect the main modulations of the carrier signal used in satellite, radio-relay and wireless communication systems.

Chapter 5 throughly analyzes how the modulation of the carrier signal and the quality of the communication link is affected.

Chapter 6 studies the conduct of the phased array and antenna that are simulated and projected in the RF propagation environment. A file transfer system with the projected antennas and a GSM communication system are implemented to allow phone calls and SMS (Short Message Service) / message texting between mobile terminals.

Chapter 7 comes with the research conclusions and with the author's private contribution to the approached thesis.