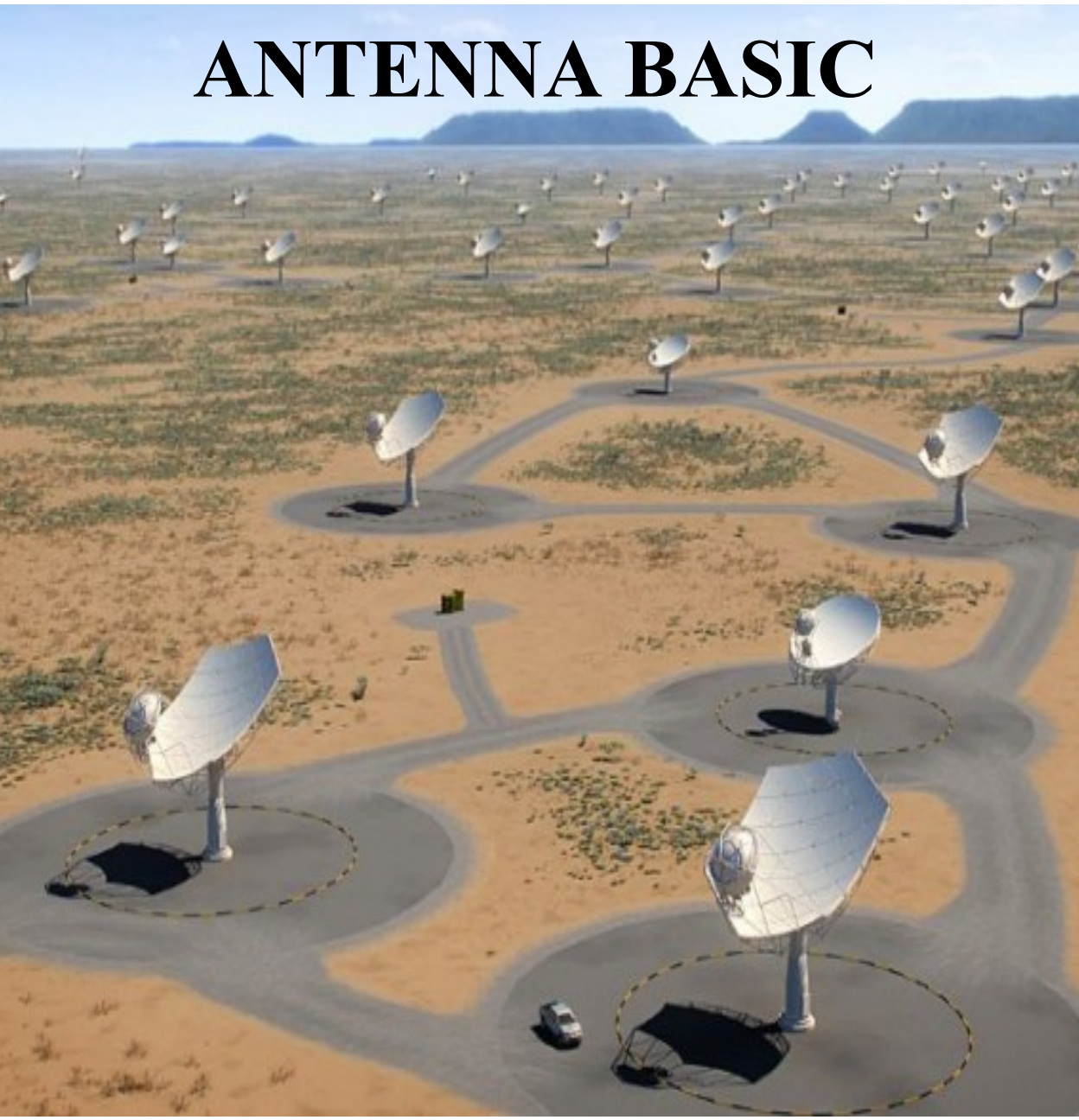
CHAPTER 5

ANTENNA BASIC



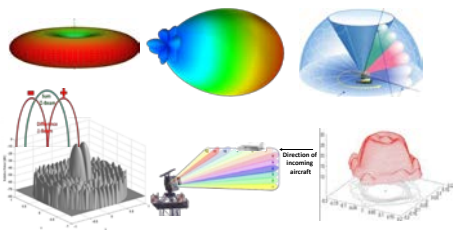
Not to solve the whole problem at once. Cut it apart.
Wise Unknown

You can learn in Chapter 5

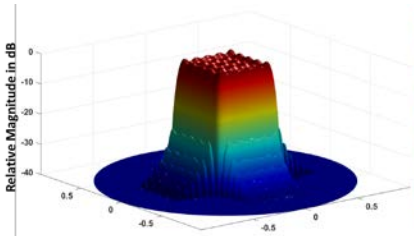
Keep in mind that the term antenna has two meanings, it can be a single radiator and an array consisting of many radiators. We will demonstrate you that practically any antenna design is based on the same principle as LEGO®, i.e. the magic of decomposition when wide-range of antennas are braked down into the set of elemental emitters like electrical, magnetic, and Huygens' radiators. Once this task is done, nothing left as to trace the interference of EM waves released by each of radiators depending on their orientation and location in space, time or frequency domain. It sounds almost trivial, but the practical design requires a lot of knowledge, intuition, imagination, and computer simulation. The prime goal of this chapter is to help you find your way in a harsh and challenging environment of antennas design, their analysis, and synthesis.

Look around, and you discover that antennas became the vital part of our everyday life being practically everywhere. They are in our pocket cell phones, Wi-Fi connected smart home devices, broadcast, and wireless communication systems, radars, garage door openers, RFID tags, remote baby monitors, missiles and smart bombs, etc. The intelligent antenna design might optimize the radiation and reception of the desired signals dynamically. If so, we decided to forsake the traditional narrative and provided our readers with a more logical approach to the antenna as a system element formulating antenna specs as a part of whole system objectives.

First, you will be introduced to the concept of traditional EM wave polarizations such as a linear, circular, elliptical, and wide variety of new class of waves with twisted polarization. We considered at length how to choose antenna polarization depending on system specs. The next section is devoted to definitions of antenna critical parameters as its equivalent circuit presentation and some matching approach to minimize the return loss, antenna quality and bandpass, concept of near-field and far-field zone, radiation pattern and its representations, noise temperature, directivity and gain, and much more.



A separate section will help you to derive antenna parameters from different system dedications that include such currently hot topic as a massive MIMO (Multiple Input Multiple Output) antenna structures for the 5G wireless platform. You will learn how to analyze and synthesize a wide variety of antennas with diverse patterns like shown on the left. You will become familiar with different techniques of beam steering including true-time delay and within-pulse managing, the main idea of synthetic aperture radar, etc. We hope that you can sail across the design of modern planar and conformal phased arrays with somewhat unique sector-shaped pattern depicted here.



The final section is devoted to the beam focusing technique and its applications.

The chapter is richly illustrated with multiple color drawings and images of antenna patterns.

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