Chapter 4
Radar Platform and Modeling

ABSTRACT
The modeling of the system is the most important step in designing procedures. Without modeling, we cannot test our system performance. The simulation and validation can be realized after system modeling. In this chapter, the authors study how to model all the proposed system components. The airborne system consists of two subsystems. The first one is the airborne radar, and the second one is the airborne self-deception jammer system, so they study how to model the airborne radar system and its main components such as transmitter, receiver, and antenna. The radar transmitted signal will be modeled. All the radar system modeling must achieve high probability of detection and low probability of false alarm. The target also will be modeled, and different targets types will be introduced. These targets have different cases, such as fluctuating and non-fluctuating targets. The environment effects such as clutter (ground clutter, sea clutter, weather clutter) and the different jamming models will be also introduced.

AIRBORNE SYSTEM PLATFORM
In this book a complete airborne system that contains two subsystems was proposed to improve the function of the airborne radar and overcoming all the problems, the first subsystem is an airborne radar, and the second one is a self-deception spoofing jammer source, Figure 1 shows the proposed system configuration, in this Figure we can see airborne system faces many problems such as the different clutter type’s effects, and jamming effects.
An airborne radar system that uses a common antenna for both transmitting and receiving is called airborne monostatic radar. It is sometimes referred to as a special case of the airborne bistatic radar, when the distance between the transmitter and receiver equal zero, and both the transmitter and receiver are travelling at the same velocity. Figure 2 shows the Modeling overview of an airborne system. We will now introduce the airborne monostatic radar platform. The radar platform (located at original position) is assumed to be moving parallel to the ground in the $x$- direction at velocity $\vec{v}_p$. The air target plan is also assumed to be planar. The scalar $\varphi$ denotes azimuth angle, $R_s$ is the slant range, $R_g$ the ground range, and $H$ is the height of the platform and $\theta$ the depression angle.

**RADAR MODELING**

The basic functions of radar are detection, parameter estimation and tracking. The most fundamental one among these functions is detection. Detection is the process of determining whether the received signal is an echo returning from a desired target or consists of noise only.
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