Chapter 5
Advanced Techniques for Range Detection

ABSTRACT

Range detection is the main significant goal of radar systems. The radar illuminates the targets to the user and then calculates its parameters. The range is the most important parameter. In Chapter 2, the authors discussed the range detection criteria for the general radar and then emphasized the range detection in airborne radar systems. The range detection in radars suffers from many problems, especially in airborne radar systems where the clutter and jamming are highly affected by the targets’ echoes. Also, due to the high relative speed between the air targets and the airborne radar, the range migration problem will happen, and the power loss problem will affect the SNR. So, in order to have a high probability of detection, one must compensate for these problems. This chapter will explain all these problems and how to solve them.

ASO/TVGA TECHNIQUE FOR POWER LOSS COMPENSATION

The range detection problems can be addressed by using the recently techniques in range detection such as the time varying gain amplifier (TVGA) that will compensate the power loss due to range and using the negative impedance technique to enhance this amplifier linearity to get a wide dynamic range for the radar receiver, also the hybrid technique between SOKT, and the IFrRT
was proposed to compensate for the range migration, finally OSTAP was used for jamming and clutter removing. We will divide this chapter into two main parts the first one is the limited input dynamic range and power loss due to range problem and how to compensate using ASO/TVGA, the second part is the range migration, clutter, noise, and jamming problems and how to solve using OSTAP/SOKT/IFrRT.

The airborne radar system designed to detect aircraft, ships and vehicles at long ranges and perform control and command of the battle space in an air engagement by directing fighter and attack aircraft strikes, the radar on the aircraft allows the operators to detect and track targets and distinguish between friendly and hostile aircraft much farther away than a similar ground based radar, however, the main purpose of the airborne radar is the detection of ground moving targets, and it can be used for the detection of the space borne targets Wu et al. (2012). Also the airborne radar is usually worked at the enemy’s sides, so it needs to exempt from the enemy’s threats, the deception jammer is a good method for attacking and countering these threats, the deception jammer source was improved to introduce more effectiveness on the enemy’s radar receivers now we will introduce the background of each contribution from this book.

This book proposes a hybrid technique between the negative impedance compensation and ASO/TVGA, where the TVGA has been proposed to compensate the power loss due to range, and the negative impedance compensation for improving the linearity of the TVGA based on adding an emitter resistance to the amplifier circuit and adaptively tuning its value for the optimized linearity ASO and gain, in order to experimentally verify the linearization effects of the proposed method, ADS has been used to perform the measurements for two sinusoidal signals separated in frequency, this technique will overcome the drawbacks of the traditional methods, because it hasn’t limited distance, and it doesn’t depend on IF stages, the linearity and the gain of the ASO/TVGA was increased comparing with the TVGA without applying ASO.

**Theoretical and Problem Formulation**

There are two potential problems in radar systems, the power loss due to targets range, and the robust difference in the power level of the returned signals from the targets, the researchers give more interests on how to solve these problems, they tried to introduce different techniques that helped radar
www.igi-global.com/chapter/intelligent-expert-decision-support-systems/196098?camid=4v1a