

Bachelor Thesis Task in the Electrical and Information Engineering Program

Topic: Modeling of a slot antenna for THz oscillators

Task:

At present, there are many new applications in the field of terahertz, such as detection technology and data transmission technology. In the field of communication, terahertz has great advantages, such as small size of antenna, wide frequency band, fast transmission rate etc [1][2].

In recent years, terahertz transmitters based on resonant tunneling diode (RTD) have received extensive attention. This is a quantum-mechanical tunneling-based component that can generate signals up to 2 THz.

In this work, the RTD oscillator is connected to slot antenna as feed point. The slot antenna should be analyzed from the structure and design parameters, such as slot length, slot width etc. In the experiment, the antenna model and its circuit model are analyzed with the help of 3D EM simulation software Empire XPU and circuit simulation software ADS.

The purpose of this work is to find out a suitable model of the slot antenna with circuit element. For a deeper understanding of the model, the aim is to build a simple circuit, which is based on its physical principles, with transmission line and single components. In the experiment, the relationship between the impedance and the frequency is obtained by simulating the 3D model of the slot antenna with software Empire XPU. With software ADS by Keysight, the most suitable circuit model can be found out, and the value of components can be determined by making fitting of the simulation result.

This task is to find the parameters that have the greatest influence on the impedance of the slot antenna by analyzing the results of the simulation of Empire. By comparing the simulated impedance, the three most important design parameters affecting the slot antenna are slot length, slot width, and the position of the feed point. Through the analysis of the model, the relationship between each parameter and the circuit can be found, and finally the model can be expressed only through these parameters.

Since the purpose of this work is to find a simple circuit model to replace the actual slot antenna, the output results of this model cannot exactly match the simulation results, and the results of this model have errors with the actual results. At the end of this work, the analysis of the error is given. Thus, the model can be used in other works within the allowable error range.

This bachelor thesis consists of five parts. Chapter 2 gives theoretical basis about antenna and field principle. In chapter 3, the slot antenna is analyzed with help of field simulation. Chapter 4 introduces the model of slot antenna with transmission line, and in further, the model is expressed by polynomial of slot length and slot width. In the last chapter, the results are summarized and a comprehensive outlook is given.