THE MINKOWSKI FRACTAL PATCH ANTENNA FOR GPS AND ISM BAND APPLICATION

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ABSTRACT

This report will describe the theories and techniques for shrinking the size of an antenna through the use of fractals. In particular, the Minkowski fractal patch antenna will be investigated. The Minkowski fractal patch antenna is introduced to reduce the size with miniaturization technique. This project presents the design of fractal patch antenna based on the basic structure of square antenna operate at 1.575 GHz for Global Positioning System (GPS) application and at ISM Band, from 2.4 GHz to 2.5 GHz. The fractal design is introduced into the basic structure intended to reduce the size of the element. Hence, miniaturization can be achieved. Simulation has been performed on several sets of the design structures using Microwave Office Software. The simulation result shows that fractal iteration, and the iteration factor has different effect on the reduction of the patch antenna. Experiment shows that the 1^{st} and 2^{nd} iteration Minkowski fractal patch antenna manage to reduce the antenna size, while maintaining the same resonant frequency as that of the normal square patch antenna. Fractal antennas can obtain radiation pattern and input impedance similar to a longer antenna, yet take less special area due to the many contours of the shape. Fractal antennas are a fairly new research area and are likely to have a promising future in many applications.

ABSTRAK

Laporan ini menerangkan teori dan teknik pengecilan saiz antena menggunakan pecahan atau pembahagian kepada bahagian-bahagian kecil. Secara amnya, Minkowski antena dikaji. Minkowski antena diperkenalkan untuk mengecilkan saiz antena menggunakan teknik pengecilan saiz. Projek ini berkenaan rekaan atau lakaran antena yang mengandungi pembahagian kecil yang asalnya adalah antena segiempat sama yang beroperasi pada frekuensi 1.575 GHz untuk Global Positioning System (GPS) dan pada frekuensi 2.4 GHz hingga 2.5 GHz untuk jalur ISM. Lakaran dengan pecahan kepada bahagian-bahagian kecil pada antena segiempat sama diperkenalkan untuk mengurangkan saiz antena. Oleh itu, pengecilan saiz antena akan dicapai. Simulasi dapat dilihat dengan melakar struktur antena menggunakan perisian Microwave Office. Keputusan simulasi menunjukkan pecahan kepada bahagian-bahagian kecil dan faktor pembahagian memberi kesan yang berbeza kepada pengecilan saiz antena. Kajian menunjukkan pecahan kepada bahagian kecil bagi peringkat pertama dan kedua akan mengurangkan saiz antena disamping mengekalkan frekuensi resonan dengan antena segiempat sama. Antena ini akan memberi hasil corak radiasi dan penentangan litaran elektrik terhadap pengaliran kuasa elektrik yang sama dengan antena asal tetapi mengambil kawasan yang kurang dengan bentuk kontur. Pecahan pada antena ini adalah penyelidikan baru dan kemungkinan akan digunakan pada masa akan datang.

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LIST OF ABBREVIATION

GPS	Global Positioning System
GPSr	Global Positioning System Receiver
ISM BAND	Industrial, Scientific and Medical Band
LAN	Local Area Network
IEEE	Institute of Electrical and Electronics Engineers
PDA	Personal Digital Assistant
3G	Third Generations
CDMA	Code Division Multiple Access
GSM	Group Special Mobile (Cellular Phone)
MWO	Microwave Office
dB	decibel
RCS	Radar cross-section
RF	Radio Frequency

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