

## **Performance Improvement of Patch Antennas using Modified Fractals**

**D. N. Uduwawala<sup>1\*</sup>, J. M. J. W. Jayasinghe<sup>2</sup>**

<sup>1</sup> *Department of Electrical and Electronic Engineering, University of Peradeniya, Peradeniya 20400, Sri Lanka*

<sup>2</sup> *Department of Electronics, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka*  
*\*disala@ee.pdn.ac.lk, jeevani@wyb.ac.lk*

Explosive growth in the wireless communication industry always demands high performance antennas with low profile. Performance improved patch antennas have been very successful in this context as they are low profile and can be easily integrated with the electronic circuits in modern wireless devices. Use of fractals in patch antennas is a formidable way to improve their performance in terms of bandwidth and gain. A fractal antenna which consists of a group of self-similar geometrical shapes at different scales displays multiple resonant frequencies. These frequencies are related to each other by its scale factor. Hence, a fractal antenna may not resonate at the required frequencies for an application. Therefore, appropriate modifications in the fractals are required to adjust the resonant frequencies with enhanced bandwidth and gain. This study shows that the performance of microstrip fractal antennas could be improved by modifying the fractals using genetic algorithms (GA). The GA optimization enables the resonant frequencies of the fractal antenna to be adjusted to desired frequencies with enhanced bandwidth and gain. This is demonstrated by modifying the fractals of a 200 mm x 20 mm 2<sup>nd</sup> iteration Sierpinski gasket patch antenna and a 40.5 mm x 40.5 mm 3<sup>rd</sup> iteration Sierpinski gasket patch antenna. The modification of the fractals could be done in many ways. Three methods namely, movement of the fractals around, removal of fractals and stretching the fractals have been used in this study to obtain novel antenna designs. The first method was used with the first antenna to enhance the broadside gain to 10.3 dB. The second and third methods were used with the second antenna. The second method was not successful in enhancing the performance of the antenna but the third one was. However, the best method of modifying fractals of the antenna depends on the particular antenna considered.

**Key words:** Patch antennas, fractal antennas, genetic algorithms, Sierpinski gasket antennas