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Biomaterials and Bionics Applications

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Abstract

This letter is the first to apply the bionics principle to the lowering of antenna Radar Cross Section (RCS). A unique bionic Ultra Wideband (UWB) antenna is suggested to validate the method using a model of an insect tentacle. Simulated and tested results confirm its UWB related radiation properties.

A standard printed circular-disc monopole antenna's monostatic RCS is analysed and contrasted with that of an Insect Tentacle Antenna (ITA) terminated with three distinct loads (PCDMA).

The findings demonstrate that the innovative bionic antenna has better radiation performances and a reduced RCS when compared to the reference antenna. Therefore, it is possible to apply bionics principles to antenna RCS reduction, which makes it a good option for the design of future antennas that need to regulate RCS. The scientific field of bionics systematically focuses on the technical implementation and application of the structures, functions, and principles of development that are present in biological systems. The term "bionics," sometimes known as "biomimetics," refers to a "symbiosis" of the conceptual and practical philosophies of biology and technology. While basic biological research makes use of contemporary technology, including its techniques and tools, and to some extent also raises questions to gain a deeper understanding of biological processes and systems, bionics is the actual application of biological discoveries to the technological domain.

Keywords:* *Bionics; Planar monopole; Biomaterials; Insect Tentacle Antenna (ITA); Radar Cross Section (RCS)

Introduction

Electromagnetic signalling has a significant but frequently ignored impact on how cells, tissues, and biological systems behave. Natural electrical signals that take the shape of electromagnetic fields, ionic electrical charges, or even direct electrical charges have the power to alter a variety of cellular processes. In order to externally replicate or influence these electronic signals, medical bionics involves the interface of biological and electronic systems. While measuring the ionic fluxes related to action potentials or muscle contractions allows communication from tissue to electronic systems (recording systems are discussed in more detail in), controlling the electrical field or applying voltages, currents, or charge to stimulate cells *via* electrodes can be used to communicate information to cells.

Cells, tissues, and biological systems are significantly influenced by electromagnetic signalling, but this influence is typically overlooked.

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Description

A number of cellular functions can be changed by natural electrical signals that manifest as electromagnetic fields, ionic electrical charges, or even direct electrical charges. Medical bionics involves the intersection of biological and electronic systems in order to externally recreate or alter these electronic signals. While recording systems are discussed in more detail in, controlling the electrical field or using voltages, currents, or charges to stimulate cells via electrodes can be used to transmit information to cells. This is in contrast to measuring the ionic fluxes related to action potentials or muscle contractions, which allows communication from tissue to electronic systems recording systems are discussed in more detail in.

Conclusion

We emphasised that in order to decrease the energy drain needed to power the system, the organic conducting materials to be employed to enable successful cellular communications must first have suitable electronic properties, provide high conductivity, and low impedance. In order to increase charge injection capacity and prevent possibly harmful, no faradaic interactions at the electrode/cellular contact, low impedance is also crucial. The future of flexible electrodes, in which the conductor is flexible or is easily fabricatable into a flexible device, depends in the continuous development of materials with adequate mechanical properties.

Both theoretical and experimental studies of PCDMA and ITA's radiation properties have been conducted. Additionally, their monostatic RCS values are simulated, assessed, and contrasted. The findings indicate that ITA has lower RCS and superior radiation properties to PCDMA. ITA is an effective UWB antenna with good radiation characteristics and simultaneously appealingly reduced RCS. Additionally, it serves as a strong illustration of the viability of the suggested approach. The bionic radiating element's advantage in reducing RCS is established. As a result, the method of reducing antenna RCS using the bionics approach is effective.