Welcome to the Journal of Electrical and Computer Engineering Innovations (JECEI)

JECEI is devoted to the research in Electrical and Computer Engineering. The editors would like to welcome you to the Ninth issue (Vol. 5, No. 1), that contains the extended versions of the best papers of the two related conferences, third Iranian Conference on Communications Engineering (ICCE2017) and fifth Iranian Conference on Engineeing Electromagnetics (ICEEM2017). These papers focus on research works in Active dual-band dipole antenna, Printed quadrifilar helical antenna, S-band ultra-low-noise amplifier, Optical pulse compression, Non-uniformity of the electric field distribution, Ferrite material characterization, Electromagnetic absorber realization using Huygens metasurfaces, Plasma array antenna, Flexible radar absorbing nanocomposites, Microstrip antenna, Axial corrugated horn antenna, and Graphene-based IR detector.

The first article entitled “Design, Simulation and Implementation of an Active Dual-Band Dipole Antenna Using a Series Stub,” by M. Zahiry et al., proposes a new method for designing an active dual-band dipole antenna using a series stub, where it makes an independent resonance frequency higher than the main resonance frequency of a conventional dipole. The operating frequencies of the proposed antenna are 150MHz and 450MHz suitable for military applications. In order to have an appropriate impedance matching in the two frequency bands, the technique of creating an internal coaxial cable is used meanwhile by adding an amplifier in series part connected to the proposed dipole antenna, the antenna gain is improved.

The article “A Small Printed Quadrifilar Helical Antenna for BGAN/GPS Applications,” by R. Kazemi, presents an element of a 2×2-element array antenna for Inmarsat BGAN/GPS applications. This element is an axial mode printed quadrifilar helical antenna integrated with a compact feed network to provide sequential phase rotation for circular polarization (CP) radiation. The novel integrated lumped-element feed network is designed to provide a balanced RF power to the four helix arms with a 90° sequential phase difference. The design maintains a low cross polarization, and a high quality of RHCP up to ±66° in 1616-1626MHz. In this frequency range, the gain is higher than 3.5dB, return loss is better than 11dB and a perfect circular polarization performance is achieved.

In the third article, entitled “Design of an S-Band Ultra-Low-Noise Amplifier with Frequency Band Switching Capability,” by M. Shakibmehr and M. Lotfizad, authors present the design, simulation and fabrication of an ultra-low-noise amplifier with frequency band switching capability in 2.4-2.5GHz and 3.1-3.15GHz. The designed amplifier has a noise figure less than 1dB, a minimum gain of 23dB, and a VSWR less than 2. The design process starts with increasing the stability factor in the source through manipulating the inductor placement technique. Then, the input and output matching circuits for the first frequency band are designed. This process is completed by utilizing two similar stages placed successively in order to achieve the desired gain level. Switching the elements in the output matching circuit avoids the use of a similar circuit for the second frequency band.

The forth article “Optical Pulse Compression Based on Nonlinear Silicon Waveguides and Chirped Bragg Gratings,” by A. Ahmadi Pour et al., presents a CMOS-based integrated optical pulse compressor. A Silicon waveguide coated by MoS_2 for nonlinearity enhancement is used for self-phase modulation and a chirped Bragg grating utilizing corrugated silicon waveguides is employed to achieve the required anomalous dispersion. By considering low power and high compression ratio, a compression ratio of 3.5 by using a relatively low power optical pulse of 8W and a short waveguide length of 1mm is achieved.

In the fifth article, entitled “Numerical Investigation of the Non-Uniformity of the Electric Field Distribution by Injection of Net Electron Charge in TE CO_2 Laser,” by N. Morshedian et al., the distribution and deviation of electric field in the active medium of the TE CO_2 laser is investigated by injecting the net electron charge beam as a plasma generator. The electric potential and electric field distribution are simulated by solving the Poison’s equation using the method of successive over relaxation (SOR) numerical method. The electrode potential and the number of injected charged particles are respectively considered to be +75 kV and 10^8 mm^{-3}. In these conditions, the maximum energy of the electrons beam would be at the order of 1-2 eV.

The sixth article, “Ferrite Material Characterization Using S-Parameters Data,” by M. Maleki et al., presents an algorithm for characterizing ferrite materials in a single frequency using a rectangular waveguide system. In this method, the extraction of ferrite parameters is implemented through minimizing the difference between the measured data and the results from modal analysis. This method only needs the amplitude of the reflection and transmission coefficients to estimate the parameters of ferrite materials. This makes the implementation easy and eliminates the problems associated with phase calibrations and measurements. The proposed algorithm is validated by characterizing YIG and SL-470 ferrites.

In the seventh article entitled “Monopole Antenna Radar Cross Section Reduction (RCS) with Plasma Helix,” by M. Khadir et al., a new method for radar cross section reduction of a monopole antenna is proposed. In this method, a plasma helix like fluorescent bulbs is placed around the antenna element. The selected plasma parameter for this medium acts as an absorber without disturbing the antenna performance. The simulations show that radar cross section of simulated antenna is reduced in a wide frequency range. The plasma parameter is chosen in such a way that reduces RCS at 4GHz. At this frequency, the radar cross section reduction is about 10dBsm. By simulating a PEC rode with 3cm diameter and 15cm height chosen for the monopole antenna element, antenna resonates at 630 MHz.

The eighth article entitled “Electromagnetic Absorber Realization Using Huygens Metasurfaces,” by M. Samadpour Hendevari et al., deals with the realization of the electromagnetic (EM) absorber as a thin metasurface. The metasurface is based on establishing a passive surface of electric and magnetic currents using the Huygen’s principle. The metasurface can be designed using split meander lines with spiral rings. In this way, both sides of the substrate must be patterned to obtain electric and magnetic currents. It is shown that using appropriate cells based on bi-anisotropic media theory, the currents and using an appropriate omega particles, a normal absorber can be obtained.

In the next article entitled “Design and Fabrication of Plasma Array Antenna with Beam Forming,” by F.S. Mohseni Armaki and S.A. Mohseni Armaki, the design and implementation of plasma antenna array with beam forming is discussed. The structure consists of a circular array of plasma tube enclosed in a unipolar UHF band monopole antenna. The combination of this antenna with plasma excitation controller makes a beam forming smart antenna. An experimental model in UHF band is fabricated that shows a good agreement between the simulated and measured results.

In the tenth research work, entitled “Flexible Radar Absorbing Nanocomposites Based on Co-ferrite/Nano Carbon/polymeric Epoxy Resin,” by N. Rezazadeh and A. Kianvash, a cobalt-ferrite ($CoFe_2O_4$) nanoparticles were synthesized by a simple, general sol-gel auto-combustion method. For this study, electromagnetic (EM) wave absorbing coatings with different weight fractions of nano-carbon and $CoFe_2O_4$ and polymeric epoxy resin were prepared and their characteristics were fully investigated. At the frequency range of 8-12GHz for a composite including 1%wt nano-carbon and 59%wt $CoFe_2O_4$, a reflection loss lower than -5dB is obtained. The structure, morphology and absorption properties are studied by X-ray diffraction (XRD), scanning electron microscopy (SEM) and vector network analyzer (VNA).

The eleventh article entitled “Microstrip Antenna Gain Enhancement using Near Zero Refractive Index Metamaterials,” by S. Mohanna et al., presents the design and fabrication steps of a new near zero refractive index metamaterial (MTM) unit cell as a superstrate over a Rectangular Microstrip Patch Antennas (RMPA). The operation frequency is 10.3GHz and there are two resonance frequencies, one at 10.1GHz and the other one at 11.68GHz. The simulations and measured results indicate that the superstrate MTM structure, designed to place horizontally over the antenna, increases the gain to almost 2.4dB and 2.62dB at 10.1GHz and 11.68GHz frequencies, respectively.

In the twelfth article entitled “Axial Corrugated Horn Antenna with an Elliptical Tapering Function,” by A. Amn-e-Elahi and P. Rezaei, an axially corrugated horn antenna with an elliptically shaped taper appropriate for satellite communications applications is proposed. This structure is a good candidate for the feed of reflectors and also for improving the electrical properties of reflector antennas. A tapering method is used to justify the horizontal location of the corrugation profile which improves the electrical performance of the presented antenna. The simulation results of a conventional axial corrugated horn antenna with a linear taper are compared to those of the proposed antenna. These results illustrate that the cross-polarization, side-lobe level and return loss of the proposed antenna are improved by about 16dB, 4dB and 9dB, respectively.

Finally, the thirteenth article entitled “Simulation of IR Detector at Communications Window of 1550nm based on Graphene,” by A. Sotoudeh et al., reports photodetection properties of a Graphene-based device at the third telecommunications window. The structure of the device is a Graphene-silicon Schottky junction simulated in the form of an infrared photodetector. Photodetection characteristic of Graphene-silicon Schottky junction is investigated by measuring the current-voltage curve at the third telecommunications window under 1550nm radiations and the DC electrical characteristic is calculated. The simulated rectifier junction has a potential barrier of 0.31eV, the ideality factor of 2.7 and the saturation current of 10-11A. The detector responsivity under 1550nm radiations is measured about 20mA/W which is an order of magnitude larger than other Si-based detectors in this wavelength. The internal quantum efficiency (QEin) is calculated about 60% while the external quantum efficiency (QEex) is measured to be 1.6%.

The editors of JECEI wish to take this opportunity to thank the scientists and reviewers around the world who have contributed their time and expertise in the preparation of the Ninth issue of the journal.