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A New Electromagnetic Codes Design for a Functional Antenna Technology

E. Emetere Moses and Esisio E. Faith
Department of Physics, Covenant University, Canaan Land, P.M.B. 1023, Ota, Nigeria

Abstract: The progress of computational electromagnetic codes and its various applications in the world of industry was discussed. The quantum mechanical role of particulates, e.g., electrons in the electromagnetism protocols are quite complex than previous known knowledge. The mathematical model incorporating electromagnetism and quantum mechanics have been discussed with seven major postulates. Four of the postulates had been verified via real life applications. If the computer coding of the new design is achieved, it would be a perfect means of verifying existing models and foster future learning into various quantum mechanical roles of particulates in electromagnetism.

Key words: Electromagnetic codes, quantum mechanical, mathematical model, electromagnetism, various

INTRODUCTION

The first type of electromagnetic codes is the Morse code. A Morse code aids the telegraphy transmission of messages from place to place. It is a 5-bit Baudot code used for Telax system (Liang *et al*., 2008). It was first computer-like character encoding with control characters. Digital systems transfer data using electric signals in inputting, processing and outputting. Each of this commands issued by the user carry an array of electromagnetic signals the computer. In order to specify which electromagnetic signal gives a particular command or carries a specific message, codes are written to illustrate each electromagnetic signal (data) carried by the computer or appliance. Therefore, electromagnetic computer codes are codes guiding and interpreting electromagnetic signals produced by computer devices. It specify the behavior of signal and guides the transmission and processing of data into useful information. Electromagnetic coding is useful in programming appliances and applications, decoding data, telecommunications and other computer applied uses. Electromagnetic computer codes are have applied in various aspect of industries such as wired and wireless keyboard which are electromagnetically emanated. Computer keywords are regularly used to transmitted personal files or data such data.

Codes are symbolic arrangement of data or instructions in a computer program that deals with mainly electric and magnetic fields, e.g., ANSYS Maxwell. This code make use of the true element method to solve real problems like frequency-domain and time-varying electromagnetic fields. ANSYS maxwell produce an appropriate, efficient way of finding solution to the problem. For example, ANSYS maxwell enables the combination of complex circuits to design high-performance systems (Goeldi, 2013). Engineers use the electromagnetic field simulation for designing a 3-D and 2-D electromagnetic or electro-mechanical devices, e.g., sensors, actuators, motors, etc.

Another type of electromagnetic coding is the Electromagnetic Surface Patch Code (ESP5). ESP5 is a Fortran 90 user oriented computer code, based upon the method of 'moment's solution' of the electric field integral equation for the analysis of radiation and signal scattering. The code employs non-static array dimensions and thus can treat as large a problem. It is typically distributed as a Windows PC executable. The ESP5 code can treat geometries consisting of radiation problems, scattering problems and thin wires with unite conductivity.

The NEC-Basic Scattering Code (NEC-BSC) has been used for over 20 years for the analysis of high frequency antenna performance on complicated structures such as ships, aircraft and missiles. The user interface to the program consists of an input file that contains commands and data. This classical mechanism is flexible, transportable and efficient. In contrast, modern graphical user interfaces provide very high levels of user interaction at the expense of transportability.

NEWAIR3 is a new electromagnetic code written in standard Fortran 77 to compute the near and far zone radiated fields for antennas mounted on a composite ellipsoid and in the presence of a set of flat plates. Since the NEWAIR3 code is based on the Uniform Geometrical Theory of Diffraction (UTD), the structures that can be

Corresponding Author: E. Emetere Moses, Department of Physics, Covenant University, Canaan Land, P.M.B. 1023, Ota, Nigeria

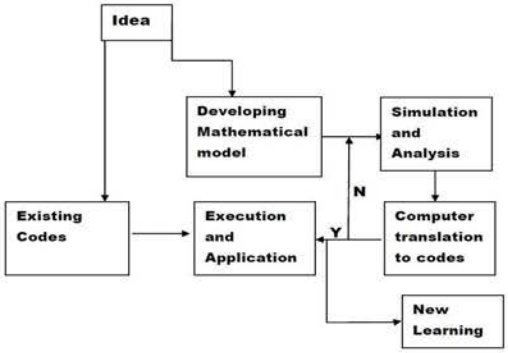

Fig. 1: Flow chart for new electromagnetic code design

analyzed have to be electrically large. In terms of the scattering from plate structures, this means that each plate should have edges at least a wavelength long. In terms of the composite ellipsoid structures, its major and minor radii should be at least a wavelength in extent. In addition, each antenna element should be at least a wavelength from all edges. In some cases, the wavelength limit can be reduced to a quarter of a wavelength for engineering purposes.

MagNetv7 is based on the highly accurate finite element method for simulating non-dynamic systems and predicting the performance of any electromagnetic device, e.g., magnetic recording heads, sensors, etc.

The roles of quantum mechanics of particulates in electromagnetism have compromised the validity of previous electromagnetic codes. In this study, we showed the seven postulates which describe the quantum mechanical roles of particulates in electromagnetism. The application of some of the postulates to real problem had been perfect. We believe that if its computer code is successful achieved, it would be a perfect means of verifying existing models and foster future learning into various quantum mechanical roles of particulates in electromagnetism.

MATERIALS AND METHODS

Execution flow chart for new electromagnetic code: The electromagnetic code algorithm is usually applied to large arrays because it has no theoretical size limit although, it can also be used for detailed modeling of very small antenna systems. We designed a flowchart for enhancing electromagnetic coding via basic quantum mechanics (Fig. 1). Here, the 'idea' is to account for most of the quantum mechanical roles in electromagnetism. The mathematical model has been developed (Emetere, 2014). Seven postulates emerged. The simulation and analysis of the first four postulates to different real problems was successful. Hence, the urgent need to translate the postulates into computer codes is necessary to verify existing model and foster new learning.

On going electromagnetic computer codes for solving real problems: Advanced electromagnetic codes are used for the design and analysis of antennas. Some codes are based on asymptotic solution of the Maxwell's equation while majority are based on a full-wave formulation of the Maxwell's equations and associated boundary conditions. The main advantage of full-wave formulation of the Maxwell's equations is its flexibility to incorporate new ideas and technology. For example size reconfiguration of antennas and its compatibility with external circuits.

Recently, scientists have initiated the idea of integrating a small antenna into an electronic chip. This idea is made possible if electromagnetic waves are generated not only from the acceleration of electrons, but from a phenomenon referred to as symmetry breaking of the electric field in space within the spatial configuration of the radiating system (Sinha and Amaratunga, 2015). Emetere *et al.* (2015) had earlier proposed the possibility of antennas (plasma) to experience the femto spin demagnetization of particulates. This work partly explains the possibility of dielectric medium to emit electromagnetic waves. From the basics, Maxwell postulated four equations which explain the causes of electron acceleration in metallic antennas:

$$\nabla \times E = \frac{P}{\varepsilon_0} \tag{1}$$

$$\nabla \times E = -\frac{\partial B}{\partial t} \tag{2}$$

$$\nabla \times B = \mu_0 J + \mu_0 \varepsilon_0 \frac{\partial E}{\partial t} \tag{3}$$

$$\nabla \times B = 0 \tag{4}$$

Equation 1-4 represents the Coulomb's law, Faraday's law, Ampere's law and Gauss's law, respectively. Here, E is the electric field, p is the charge density, ε_0 is the permittivity of free space. B is the magnetic induction, π_0 is the permeability of free space. J is the current density. The incorporation of quantum mechanics into electromagnetism via a mathematical model has been illustrated in previous publications (Uno and Emetere, 2011). Seven postulations were induced from mathematical model of quantum mechanics and electromagnetism, i.e.:

$$E_{rt}+\left[\frac{h^2}{2m}\left|B_r-eA\right|^2+\left|B_Z+V_oe\right|^2-\left(\left|B_Z-E_oe\left(\frac{a^2}{r}-r\right)\right|^2-\left|B_Z\right|\right)+2E_oV_oe^2+\beta e_r\right] \quad (5)$$

$$E_r=\beta E_re_re^{-j\beta r}(\sin\theta+\cos\theta)$$

$$\frac{\partial}{\partial t}\left[\left(B_Z+V_oe\right)E_r{}^2\right]-\frac{\partial}{\partial t}\left(B_Z+E_oe\left(\frac{a^2}{x}-x\right)\right) \quad (6)$$

$$E_r{}^2-\frac{1}{2}\frac{\partial B_Z}{\partial t}=0$$

$$\frac{h^2}{2m}E_r{}^2\frac{\partial}{\partial_t}\left(B_r-eA\right)=\beta B_rf_re^{-j\beta r}\left(\sin\theta+\cos\theta\right) \quad (7)$$

$$\frac{\partial}{\partial_t}E_z\frac{\partial}{\partial t}E_ze_ze^{-j\beta r}\left(\sin\theta+\cos\theta\right) \quad (8)$$

$$2\left|B_z-E_oe\left(\frac{a^2}{r}-r\right)\right|E_rE_oe\left(\frac{a^2}{r^2}-1\right)=\frac{j\beta}{8\pi} \quad (9)$$

$$\left[\frac{E_re_r}{r}\left(\sin\theta+\cos\theta\right)+\frac{2B_rf_r}{r}\left(\sin\theta+\cos\theta\right)\right]\beta e^{-j\beta r}$$

$$\frac{1}{8\pi\left[\beta E_r(a,z)e_r+\beta B_r(a,z)f_r+E_z(a,z)\right.} \quad (10)$$

$$\left.e_z+B_z(a,z)f_z\right[\cos\theta-\sin\theta]=0$$

$$\frac{1}{8\pi\left[-\frac{2}{z}e\right]^{-j\beta r}\sin\theta\left(B_z(a,z)f_z+E_z(a,z)e_z\right)} \quad (11)$$

$$-\frac{2}{z}e^{-j\beta r}\cos\theta\left(B_z(a,z)f_z+E_z(a,z)e_z\right)=0$$

Where:

α and γ	=	The attenuation factors of the electrical fields
$E_\gamma(z)$ and $E_\alpha(z)$	=	The electric fields generated by the polar difference
β	=	The frequency of excited power
j	=	The antenna current
r	=	The radius or horizontal component of the antenna
z	=	The vertical component of the antenna
m	=	The magnitude of the particulates
ξ	=	The electrical permeability
π_0	=	The magnetic permeability
e_r	=	The spin factor which determines the electron spin along the horizontal component
e_z	=	The spin factor which determines the electron spin along the vertical component
v	=	The total potential in space or near earth surface
V_o	=	A constant on the surface of the charged air
E_o	=	The electric field and a is the antenna potential
x	=	The Dybe length

The first four postulates have been verified upon its application to salient aspect of the antenna. For example, postulate 1 was used to resolve the magnetic field effects on the sheath of the plasma antenna (Emetere, 2014). Postulate 2 was used to resolve fading in multipath propagation in ultra wideband application (Moses, 2015) Postulate 3 was used to improve the respond time in detecting natural lightning using any electromagnetic device (Uno and Emetere, 2011). Recently, postulate 4 is applied to the MRI antenna to examine patients' excess exposure to electromagnetic radiation. Numerical simulations have been demonstrated in our previous publications. We propose that computer coding of the seven postulates would be a perfect means of verifying existing models and foster future learning into quantum mechanical roles of particulates in electromagnetism.

RESULTS AND DISCUSSION

Theoretical verification of experimental test: From Eq. 9, it is easy to relate the proposed electromagnetic codes with existing solution that is generally accepted. Denidni *et al.* (2003), worked on the dual-antenna array for mitigation of both interference and multipath effects in digital mobile communications at the handset level. The experimental performance of the technique adopted indicates gain improvement of 7 dB. In this section, we verified the experimental result theoretically (Fig. 2-4):

$$\frac{8\pi r}{j\beta^2}e^{j\beta r}\left(\sin\theta+\cos\theta\right)^{-1}\gg 2f_r,\ \beta=140\text{ MHz},\ r=y,$$

$$j=\frac{8\pi rB_r}{E_r\beta^2e_r}e^{j\beta r}\left(\sin\theta+\cos\theta\right)^{-1} \quad (12)$$

Using the remodeled Maxwell's postulates, we discover the possibility of gain improvement of 117 dB when we adopted an iterative nonlinear on off algorithm for the phase adjustment (Fig. 2). When we adopted the non iterative nonlinear on off algorithm (Fig. 4) we discover gain improvement of 56 dB. Hence for either technique, there was an improvement on the gain of the incoming signal. Also, the maximum signal transmission in the experimental phase was found about at about 0.97 m while the theoretical prediction of the iterative and non-iterative algorithm was 1 and 1.38 m, respectively.

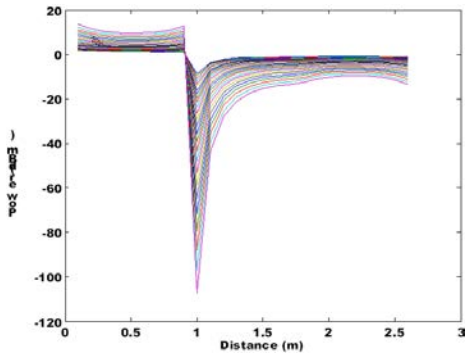

Fig. 2: The experimental performance of gain improvement

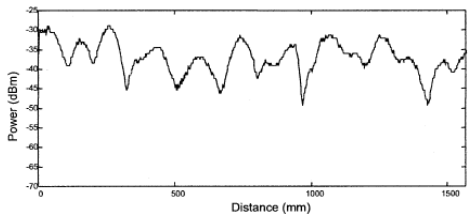

Fig. 3: Experimental field strength for adaptive dual antenna array

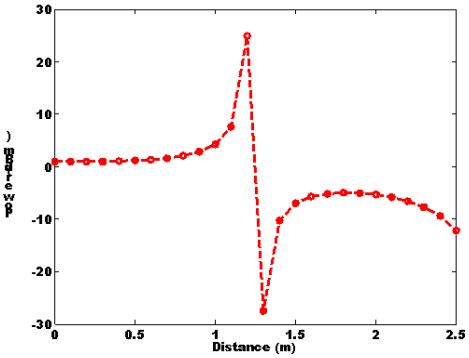

Fig. 4: Theoretical field strength for biased adaptive dual antenna array

Hence, the incorporation of the quantum mechanics into the Maxwell's electromagnetic postulates is germane and scientifically cogent for model development.

CONCLUSION

The progress of computational electromagnetic code and its various applications in the world of industry has been discussed. A significant number of "success stories" of industrial application have been already registered and these kind of codes have gained acceptance as essential tools for the design of advanced devices such as high energy physics dipoles and quadruples, electrostatic lenses, magnets for medical imaging, experimental fusion reactors and magnetic transducers and actuators. The quantum mechanical role of particulates, e.g., electrons in the electromagnetism protocols are quite complex than previous known knowledge. Recent discoveries of new phenomenon (e.g., symmetry breaking of the electric field and femto spin demagnetization) have proven that the validity of previous electromagnetic codes have been compromised. Hence, the need to revamp the old theories is needful. Seven postulates were highlighted and four has been successfully tested. The computer codes of the postulates would engender new learning of the role of quantum mechanical effect on electromagnetism.

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