ELECTROMAGNETIC SOLVER UTILIZING RGB IMAGE AS INPUT AND METHODS THEREOF

IITM Technology Available for Licensing

Problem Statement

- Computational Electro Magnetics (CEM) involves design, modeling and analysis of a wide range of devices and systems using numerical solutions to equations the said systems include Microwave Engineering, Optical and Photonics Design and validation, Radar scatter pattern analysis.
- Existing techniques such as are described as time-consuming and lacking control over simulations

Key Features / Value Proposition

Technical Perspective

- The invention discloses a method and system for **efficient computation and simulation of electromagnetic fields based on an RGB digital image of an equipment under test.**
- Processing machine configured to process the **digital image, extract material parameters, geometry, and boundary conditions, and simulate the electromagnetic solver.**

User Perspective

- The invention provides and efficient Graphical User Interface (GUI) that intakes a RGB(Red-Green-Blue)-image as input layout for performing 2D-Electromagnetic wave simulation and analyze the computed data effectively
- The method can be incorporated ideally in electromagnetic structures such **as photonic crystal waveguides, directional couplers etc.**

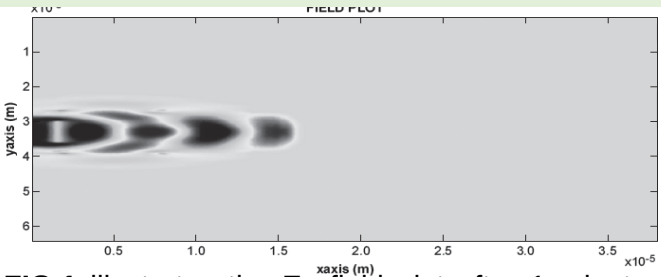

FIG.1 illustrates the Ez field plot after 1 minute of FDTD execution with a dielectric material when 'RUN SIMULATION' button was pressed

Technology

The invention provides a system and method for computing the intensity of electromagnetic fields surrounding an equipment under test (EUT)

Image Acquisition and Pre-processing:

- ✓ Capture an RGB digital image of the EUT with a predetermined spatial geometry.
- ✓ Pre-process the image to obtain material parameters, geometry, and boundary conditions as functions of spatial geometry.

Parameter Extraction:

- ✓ Extract material parameters (permittivity, permeability, and conductivity) from the red, green, and blue component intensities of each pixel.
- ✓ Extract stimuli definition parameters (source position, source geometry, receiver position, and receiver geometry) from fixed intensity values of red, green, and blue components.
- ✓ Extract boundary conditions from fixed intensity values to identify edges of the simulation domain/ boundary geometry

Input to Electromagnetic Solver:

Receive the extracted material parameters, stimuli definition parameters, and boundary conditions by a 2D-electromagnetic solver

Simulation and Computation:

- ✓ Simulate the 2D-electromagnetic solver over the identified simulation domain.
- ✓ Compute intensity of electric/ magnetic fields using either continuous time signal mode or discrete time signal mode.
- ✓ Perform computation within predetermined timeand for a specified excitation frequency.

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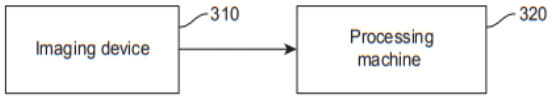
Images



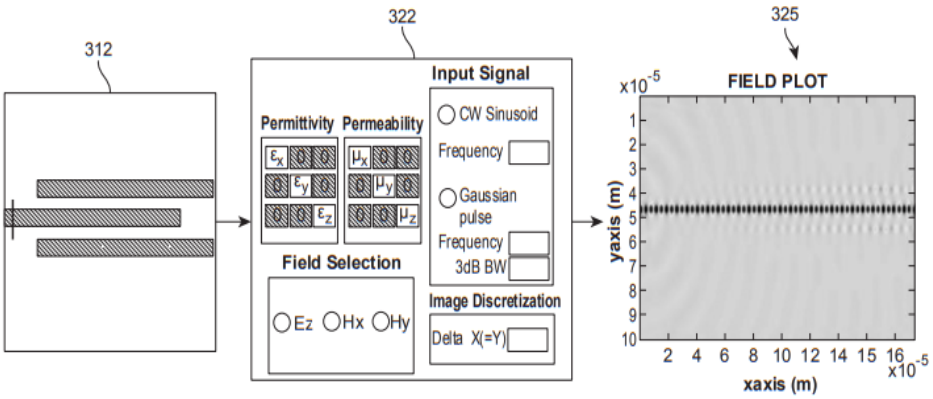


FIG. 2 illustrates the system computing the intensity of the electromagnetic field using an electromagnetic solver.

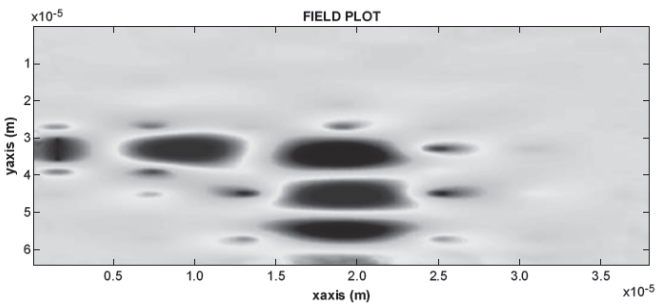


FIG. 3 illustrates Ez-plot after 5 minutes of FDTD execution with material as free space.

- The system disclosed in the given invention electromagnetic field computing system having a simulation tool that includes **RUN, PAUSE, RESUME and EXPORT functions**
- The electromagnetic solver can be selected from options such as Finite Difference Time Domain (FDTD), Finite Elements Analysis (FEA), Boundary Elements Methods (BEM), or Finite Integral Techniques (FIT).
- The invention provides and efficient Graphical User Interface (GUI) that intakes a RGB(Red-Green-Blue)-image as input layout for performing 2D-Electromagnetic wave simulation

Intellectual Property

- **IITM IDF Ref. 1519**
- **IN414663-Granted**

Technology Category/ Market

Category – Information & Communication Technologies (ICT)/ Computer Aided Design & CAD Analysis

Applications –Telecommunications, Software systems, hard ware applications, Microwave Engineering, photonic crystal wave guides

Industry – Telecommunications , Electrical

Market - The Global Telecommunication Market is valued at USD 1754.8 Billion in 2022 and is projected to reach a value of USD 2652.5 Billion by 2030 at a **CAGR of 5.3% between 2023 and 2030.**

TRL (Technology Readiness Level)

TRL- 3,Experimental proof of concept

Research Lab

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