Focus on CAD

Electromagnetic upgrades shorten simulations

Upgrades and new programs for electromagnetic simulation are promising both improved capabilities and reduced simulation times.

Compact Software's Microwave Explorer 2.0 has begun shipping, as has Hewlett-Packard's Momentum. Sonnet and OSA are working together and Ingsoft of Ontario, Canada, now has RF Laplace to simulate uniform TEM mode structures.

Compact's Microwave Explorer 2.0 is claimed to reduce analysis time by factors of 3 to 4 times compared to the previous version, with simulation of via holes up to thirty times faster. The new version also incorporates the ability to model losses in dielectric substrate.

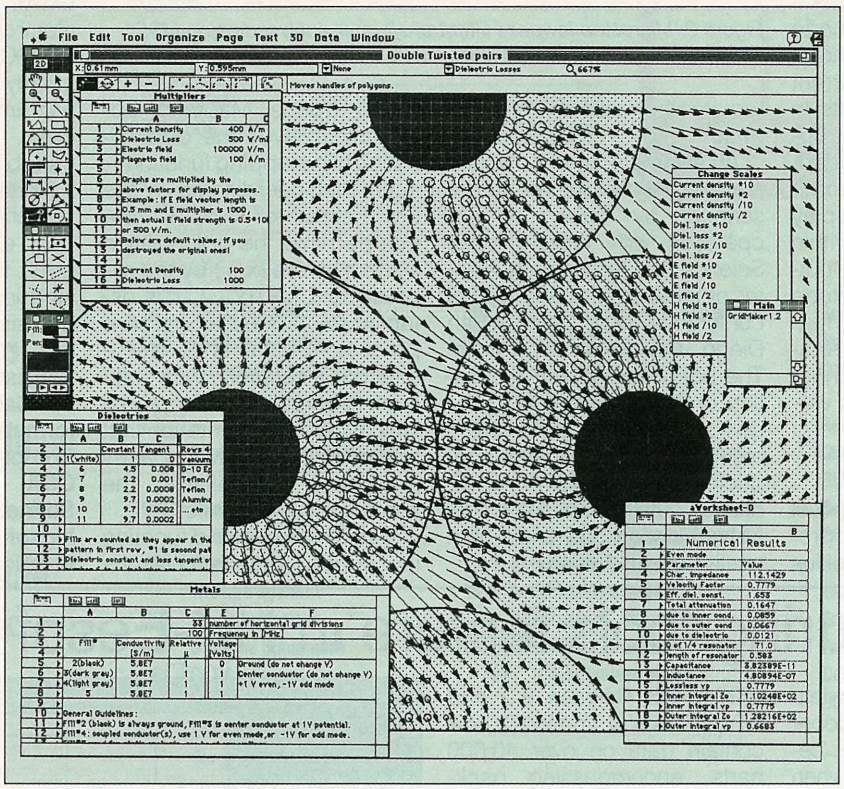

Figure 1: Field distribution in double twisted pairs of wires at 100MHz, from RFLaplace.

Intended for planar multilayer structures such as MMICs and high frequency hybrids, it employs the Method of Moments for solving the electric field integral equation across a structure.

A polygon-based geometry editor is provided, which also allows the definition of reference planes for automatic deembedding of S-parameters after simulation is complete. Editing functions such as copy, rotate, mirror and modify are included. New to version 2.0 is the provision of icon buttons for zoom in and out, grid, move and X- and Y-mirror functions.

Editing can continue while other simulations are processed as background tasks.

Simulation

Several factors influence reduced simulation times. Optimal circuit gridding, where a higher density of basis functions is used closer to a discontinuity and fewer in more uniform regions, has been introduced, and two-dimensional Fast Fourier Transforms (FFT) are employed for solution of the integral equation. FFT tables are used in tight coupling areas. In addition, new techniques have been used for modelling the vertical currents in via-holes and Z-strips (vertical striplines), which result in analysis times being virtually independent of the number of vias and Z-strips.

It is now possible to select either single or double precision arithmetic. Explorer predicts where the accuracy of the results would be degraded by the single precision option, and advises the use of double precision.

The software is self-contained, and runs on workstations such as Sun SPARC and HP 700 series.

The graphical user interface is X-Windows and OSF/Motif compatible, and uses separate windows for the geometry editor, simulation control, layout netlist, graphic simulation results and S-parameter data.

TEM modes

A new electromagnetic simulator was announced by Ingsoft, of Ontario, Canada, in late 1993. RFLaplace forms part of Ingsoft's RFDesigner suite, which runs on Apple Macintosh machines. It simulates uniform TEM mode structures, such as coaxial cables or stripline, characterizing structures determined by physical parameters, such as dimensions, conductivities and dielectric constants, in terms of electrical and transmission line properties (characteristic impedance, velocity factor, attenuation etc.).

Typical applications include the design of single and coupled transmission lines, analysis of arbitrary transmission lines, resonator design, crosstalk and coupling analysis.

Visualisation

Both the geometrical definition of structures and the visualisation display are interfaced through the graphics package MiniCAD, by Diehl Graphsoft.

Vector plots of electric and magnetic fields, equipotential contours and density plots of power loss and surface current are available.

Figure 1 shows the RF simulation of double twisted pairs of wires.

Empipe

Electromagnetic simulation is available to users of OSA/hope from Optimization Systems Associates (OSA) of Ontario, Canada, through the Empipe in-

terpolator, originally described in the May 1993 Focus on CAD in Microwave Engineering Europe. Empipe provides a link from the OSA framework to Sonnet's em electromagnetic simulator, allowing real time simulation of electromagnetic structures which are geometrically defined in OSA/hope.

In Version 2.0 of Empipe, scheduled for release during Summer 1994, direct simulation and optimization of arbitrary geometries will be made accessible through OSA/hope for the first time: in the current version, only the elements in the built-in library, with appropriate parameters added, can be simulated and optimized by em. The display functions available within OSA/hope for viewing and outputting the simulations include 2D and 3D visualisation, featuring scaling, scrolling, rotating, colouring, contouring, smoothing and plotting in various formats.

Space mapping

OSA is also developing a novel optimization technique for problems, where high sensitivities require the use of very fine grids.

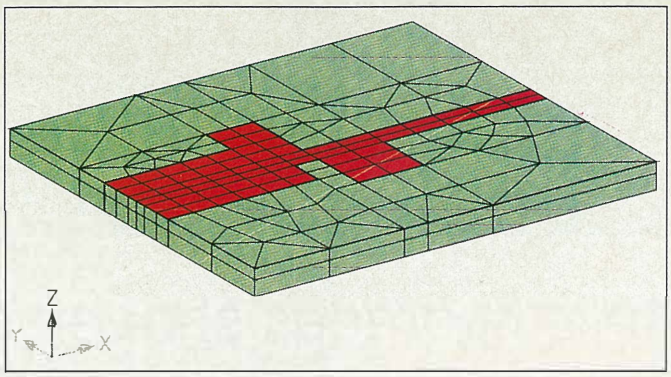

Figure 2: Microstrip lowpass filter/transformer analysed using MSC/EMAS electromagnetic simulator.

An example of this "Space Mapping" technique will be described by OSA, in cooperation with Westinghouse Science and Technology Center of Pittsburgh, at the MTT-S conference taking place in San Diego, California, this month. The paper details the application of Space Mapping to the design of a narrowband filter in high temperature superconductor (HTS) material, which causes difficulties in traditional EM simulation due to its high relative permittivity (ε_r) of 24.

The Space Mapping approach involves the determination of a mapping function T, such that coordinates in the EM simulator (x_{EM}) are mapped into the optimization system space (x_{OS}) by the expression $x_{OS}=T(x_{EM})$. T is established through an iterative process: for the HTS filter a total of 13 iterations was sufficient to establish a mapping T which fulfilled the criterion that simulations in the two spaces produced essentially the same circuit response.

Use of the mapping function in subsequent simulations produces much faster results than by using the full space coordinates.

Solid models

Enhanced visualisation of 2D and 3D electromagnetic structures is promised by the MSC/ARIES CAD program from MacNeal Schwendler Corporation (MSC), which is now available for use as a pre- and post-processor for MSC/EMAS, MSC's finite element electromagnetic simulator.

MSC/EMAS is aimed particularly at crosstalk analysis and antenna modelling with its open boundary element capabilities.

Version 3.0, will be launched next month.

An example is shown in figure 2. Figure 2 shows a microstrip lowpass filter which also acts as a transformer from the low impedance level of a transistor to a 50Ω line.

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Compact Software	**260**
OSA	**261**
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Ingsoft	**263**
MacNeal Schwendler	**264**

Manufacturing tools feature in HP-Eesof package

The purchase by Hewlett-Packard of Eesof in October 1993 will be more firmly cemented in software when Hewlett-Packard begins shipping Release 6.0 of the Microwave and RF Design Systems (MDS/RFDS) next month. New features include statistical functions for yield analysis, access to the Eesof active and passive libraries, and improvements to the user interface. Component placement is simplified by means of palettes and the introduction of an "interactive transmission line calculator", which computes impedances directly from the schematic. The most notable change to the new release, however, is the availability, in a new add-on package, of simulation and statistical capabilities for design-for-manufacturing optimization.

Libraries

The combined HP-Eesof libraries, which are common to both MDS/RFDS Release 6.0 and EEsof Series IV Version 5, now contain data on over 40,000 parts, encompassing packaged and chip FETs and BJTs and surface mount passives. Newly introduced is a Philips GaAs foundry library, containing 120 high frequency components for both Philips D07A and ER07AD processes, to allow design of custom MMICs.

MDS now includes a library browser to allow rapid search and placement of selected parts into a schematic. New palettes have also been introduced to simplify placement of standard transmission line components.

Manufacturability

The new release includes access to simulation and statistical functions which facilitate tuning and refinement of circuits to maximize yields in manufacturing.

The HP 85149A/AN High

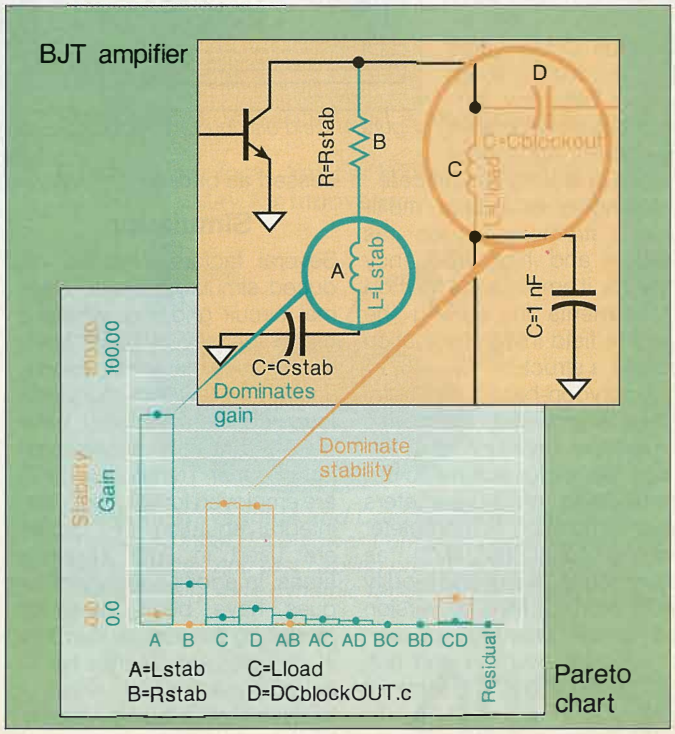

Figure 1: Pareto Chart output from HP High Yield Software package, showing which circuit variables and interactions affect performance.