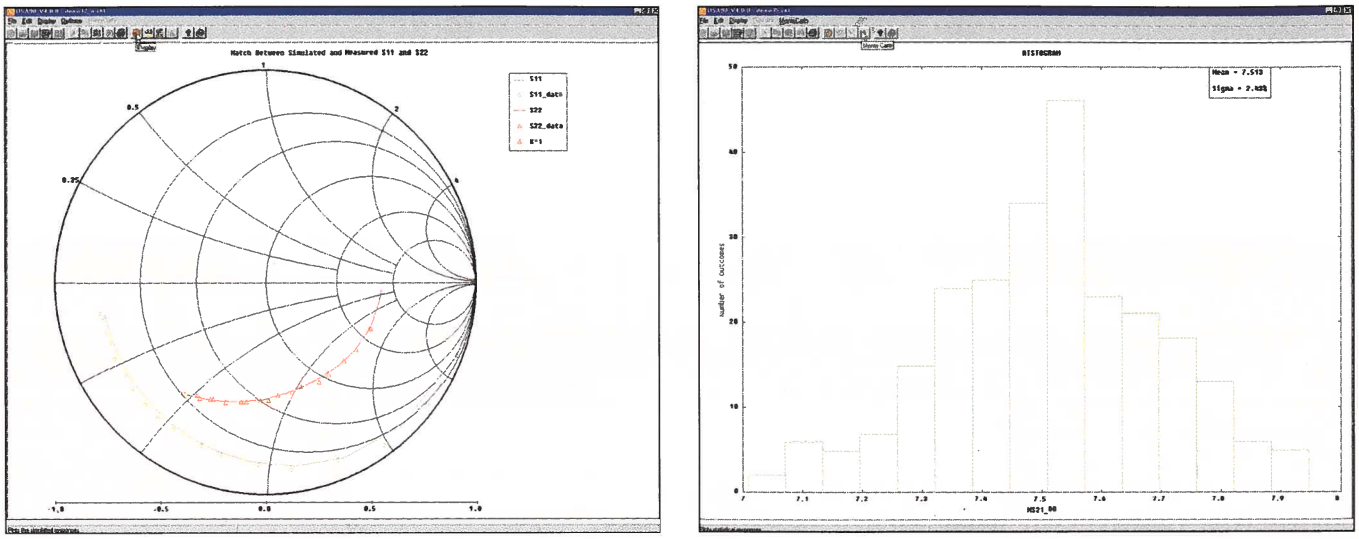

Figure 1: Screen shots of OSA90/hope from Optimization Systems Associates, now operating under the Windows environment.

PC debut for EM simulators

With the rapid increase in processor speeds for personal computers which has occurred over the last two years, the PC has now become a real alternative to the workstation as a platform for running electromagnetic simulators as well as circuit simulation software. Optimization Systems Associates (OSA), of Ontario, Canada, will launch PC versions of three of its software packages, OSA90/hope, Empipe and Empipe3D, at the MTT-S International Microwave Symposium (IMS) in Denver, Colorado next month. A French electromagnetic package, SAPHIR from IPSIS, which specializes in simulating planar radiating structures, makes its debut in PC format this month, while another electromagnetic simulator recently ported to the PC environment is Micro-Stripes from KCC of Nottingham, UK.

Solvers

OSA90/hope is a general purpose CAD system, while Empipe and Empipe3D are both optimization packages each of which drives the two electromagnetic field solvers, Sonnet em and Ansoft Maxwell Eminence. The UNIX version of Empipe3D was first described in the February/March 1997 issue of Microwave Engineering Europe. In addition to retaining all the functionality of the UNIX programs, the PC versions include some new features specific to the Windows 95 and NT environments. Among these are an enhanced user interface following the Windows conventions, online help, and a simplified installation procedure.

Another new feature is the ability to print directly to an attached printer without the need to produce an intermediate printer file. Both Windows 95 and Windows NT provide a mechanism similar to the UNIX Datapipe facility, which allows inter-process communication between the optimization software and the two solvers.

Speed

Although no rigorous benchmarking has taken place, OSA has observed that tasks in a single-user environment are typically completed up to twice as fast on a state-of-the-art Pentium machine compared to an older Sun SPARCstation 10.

In a paper which will also be presented at the MTT-S IMS, OSA will describe for the first time the use of its "Space Mapping" method to align the results of two separate electromagnetic simulation systems. The fast, or coarse, simulation, in the "Optimization Space" (OS), is provided by the RWGMM library of waveguide building blocks developed at the University of Bremen, while the fine model is developed in Maxwell Eminence, accessed via Empipe3D. These two models are linked with the network theory optimizers of OSA90/hope, and all three systems are executed concurrently by the Space Mapping procedure. Using as an example the design of an H-plane resonator filter with rounded corners, as shown in figure 2(b), the paper describes the alignment of its response with that of the OS model with sharp corners shown in figure 2(a). The diameters of the irises, d_1 and d_2, and the cavity lengths l_1 and l_2, are used as the optimization variables. Two solutions for the responses, one after minimax optimization of the OS model, and the other after direct optimisation of the fine model in Maxwell Eminence driven by Empipe3D, were compared and found to be essentially in agreement.

Planar structures

IPSIS, of Rennes, France, is this month launching a major revision of its SAPHIR electromagnetic simulator: Version 2.4 will operate for the first time on a PC, under Windows 3.11, Windows 95 and Windows NT. The existing version, SAPHIR 2, runs only on UNIX workstations. SAPHIR was originally developed jointly by CNES Rennes and INSA in Toulouse, along with IPSIS itself, and until now has not been widely available outside France.

Aimed particularly at the sim-

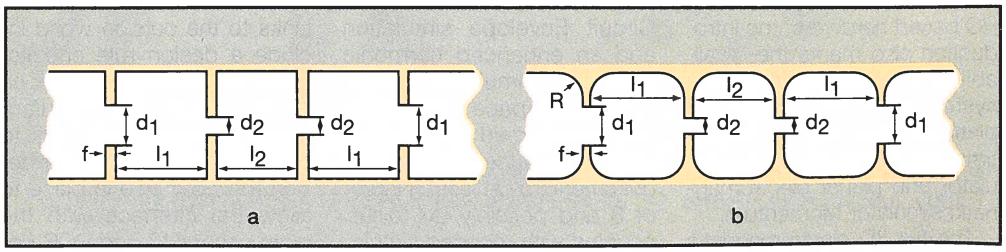

Figure 2(a): Ideal model of H-plane resonator filter with sharp corners, used as an optimization space (OS) model in OSA90/hope for Space Mapping of real filter with rounded corners, as shown in figure 2(b).

ulation of planar radiating structures such as travelling wave antennas and planar arrays, SAPHIR is based on a rigorous full-wave electromagnetic analysis by means of electric field integral equations, combined with the Method of Moments. Models are drawn from a library of basic elements, including dielectric layers, arbitrarily shaped patches, line or coaxial feed probes, via holes and matched or lumped loads. New to Version 2.4 is the ability to simulate both planar structures without a ground plane and slotted structures, and the use of either slot lines or coplanar striplines as feed elements. There is no restriction on the number of ports, and the treatment includes the capability of handling dielectric and conductor losses and dispersive effects. The inductive effects of coaxial probes and via holes are modelled using vertical meshing.

Patterns

Multilayer patterns are entered using a shape editor, with selection of elementary models using toolbar icons. Arbitrarily shaped patterns can be defined without grid dependency, and the geometry can be fine-edited before simulation. Both near- and far-field characteristics are obtained from the same calculation.

The simulation results can be viewed in a variety of formats. Particular emphasis is given to presenting results in the same format as practical measurements on the structure would appear: radiation patterns, copolar and cross-polar data and polar plots, as well as S-, Z- and Y-parameters in rectangular and Smith chart formats. The 2D and 3D current density plots are available for conductor sections. S-parameter files can be output in industry standard format, for use with most common circuit simulators. Figure 3(a) shows an example of a symmetric crossed antenna, which was simulated in X-band using SAPHIR. Figure 3(b) shows some of the available outputs from this simulation.

Micro-Stripes 97 from KCC is a suite of programs for performing full 3D electromagnetic analysis of arbitrary geometries, using the Transmission Line Modelling (TLM) method, which provides results in both the time domain and the frequency domain. Micro-Stripes 97 offers an upgrade to existing Sun and HP workstation users, as well as a new version for use under Window 95 and Windows NT.

Structures suitable for analysis by Micro-Stripes include waveguide components, single-element or array antennas, resonators, transitions and microstrip circuits.

Shape capability

A definable shape capability has been added to the build model program, allowing a geometric shape of any complexity to be assigned a name and referred to any number of times. This simplifies both input and modification of data files.

New features in the TLM simulator module include a job queue facility. Filtered excitation, which ignores frequencies above the maximum permitted by the mesh, results in smaller time-domain output files and reduces computation time when space-domain output is requested. The capability of defining more than one initial mode excitation has been introduced, which can be used for generating circular polarization and for phasing antenna arrays. Wires can now be defined in graded areas of the mesh, and anisotropic materials can be handled.

The graph plotter is now able to plot Smith charts directly without exporting to an external graphing program, and has added a grid overlay option and location of maxima and minima.

The calculation routine to translate from near- to far-field values has been speeded up by a factor of two, and now automatically includes symmetry planes to represent ground planes where antennas feed through metal grounds. Far-field plots can now be performed with angles drawn from the top as well as from the

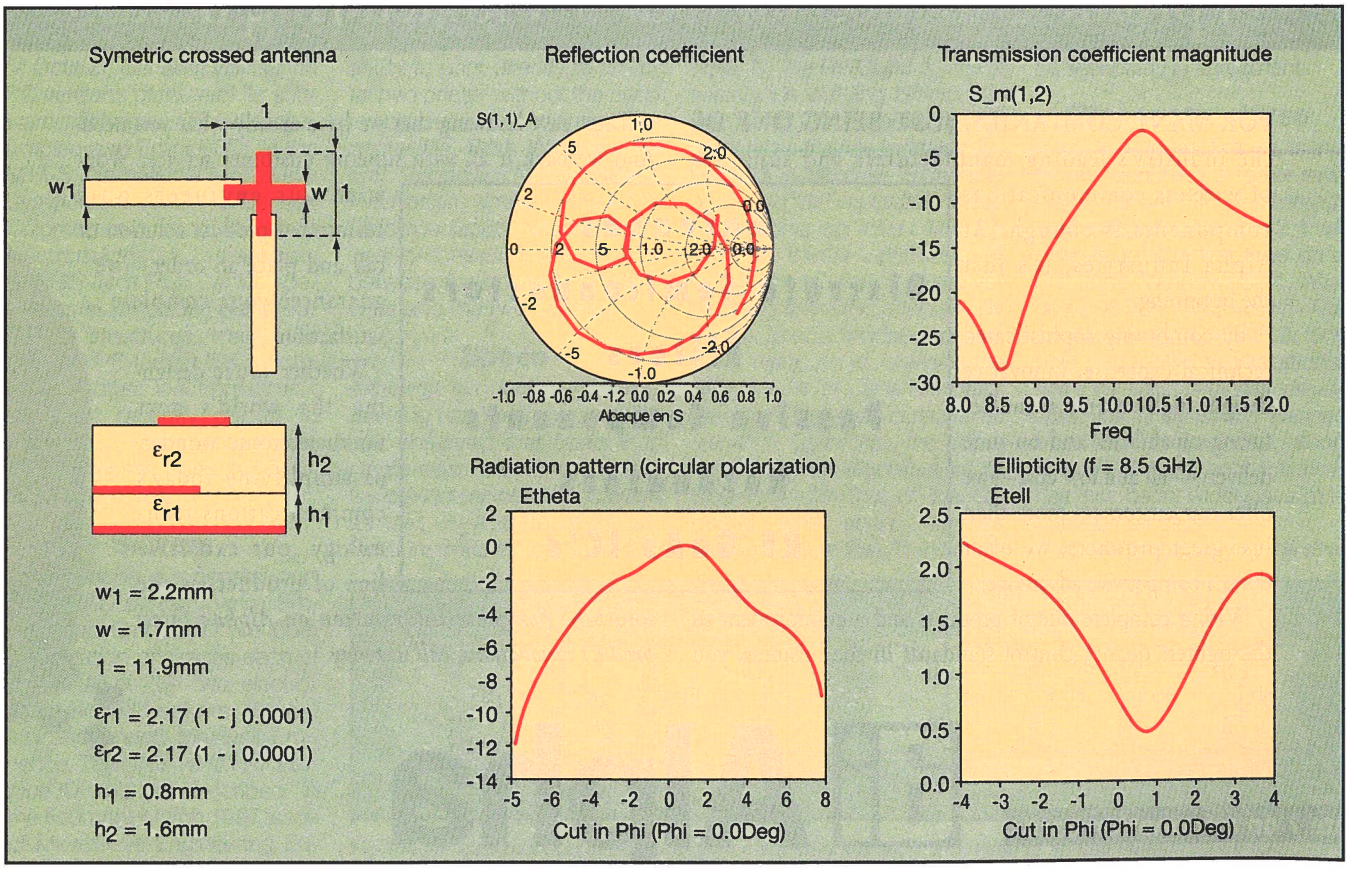

Figure 3(a)(left): A symmetric crossed antenna, which was simulated in X-band using the SAPHIR electromagnetic simulator from IPSIS. Figure 3(b)(centre and right): Some of the available outputs from the simulation of the crossed antenna.

front, and multiple or arbitrary cuts may be made through the 3D radiation pattern to display relative power versus angle.

Model generation

Also new from KCC is EMCAD, a CAD interface and graphical solid modeller which allows models of 3D structures to be created and revised. After modelling, electromagnetic properties can be added before meshing is performed for subsequent analysis by Micro-Stripes. CAD input is accepted from IGES, STEP or DXF. Boolean and other solid geometry generation tools are incorporated. Available initially with node-locked licensing for Sun and HP700 series UNIX workstations, a PC version of EMCAD and floating licensing are due for release later in the year.

Figure 4 shows a screen shot of EMCAD modelling a 3D structure.

One full-wave electromagnetic simulator which has been available for some time on the PC is Ensemble, from Boulder Microwave Technologies, which is specifically aimed at planar circuits and multilayer printed antennas. Version 4, which was launched last year, uses a combination of integral equations and the Method of Moments to produce results for S- and Z-parameters, 2D copolar and cross-polar radiation patterns, and vector current plotting and monostatic RCS, both in two dimensions.

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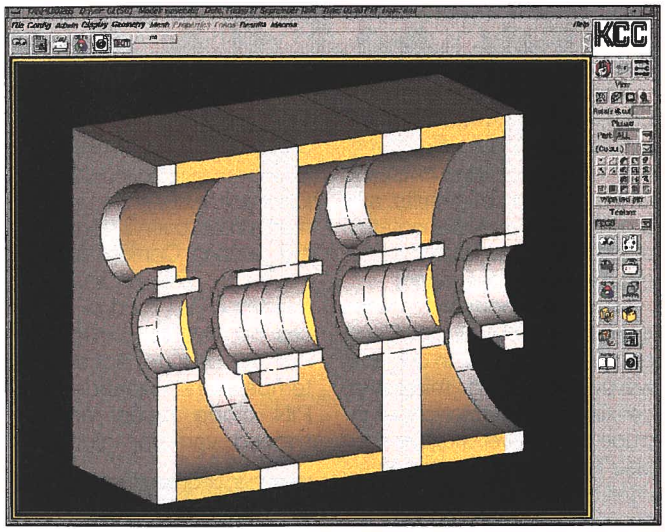

Figure 4: EMCAD 3D solid modeller from KCC.

OSA	**260**	**KCC**	**262**
IPSIS	**261**	**Boulder Microwave**	**263**

Circuit simulators target performance & platforms

Linear and non-linear circuit simulators continue to extend their capabilities, often with the addition of new library models or additional software modules to perform functions such as electromagnetic simulation of components and layout of circuit boards. The move towards full-featured versions for the PC, often upgraded in parallel with their workstation counterparts, has been dramatic: most major vendors now offer a package for use in a Windows 95 or Windows NT environment, and in some cases the PC version has become the flagship product.

Compact Software, which has recently been taken over by Ansoft, has announced Version 7 of Serenade for the PC, with several new features which are mirrored in an upgrade to the workstation version. Jansen Microwave, a member of the European EDGE (Enhanced Design for GaAs/Si in Europe) initiative, part of the ESPRIT programme, has launched LINMIC+/N 4.1, a major upgrade to its circuit simulator. LINMIC+/N 4.1 incorporates an entirely new Graphical User Interface (GUI), which has been developed as part of EDGE and which will form the common framework for accessing other software from members of the EDGE consortium and also for interfacing to third party software.

Also recently upgraded is MMICAD from Optotek of Ontario Canada, which now includes layout capability and has an integral filter synthesis facility. In addition Optotek's UK distributor, Wessex Electronics, has described the use of a program called QuickCircuit, which interfaces with MMICAD to control a milling machine producing the circuit board in prototype quantities: a rare instance of computer-aided manufacture (CAM) entering the RF and microwave domain.

Frequency domain

Serenade 7 PC is the latest version of Compact Software's design suite for microwave and RF circuits. Serenade combines the Super-Compact and Microwave Harmonica frequency-domain simulators with schematic capture and device libraries. An op-

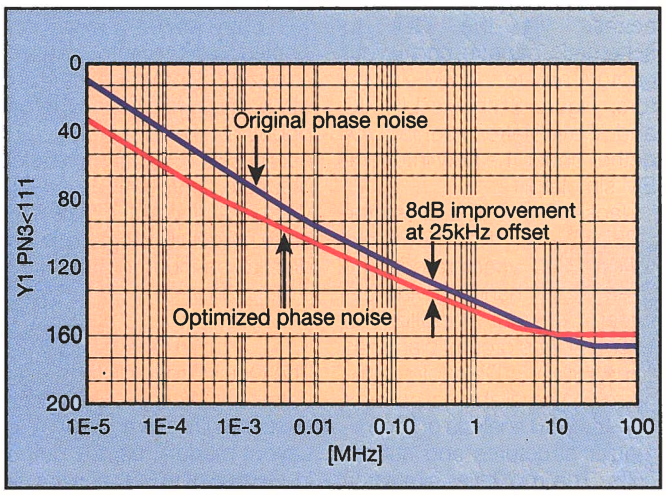

Figure 1: Example of phase noise optimization on Compact Microwave Harmonica 7, which is available for oscillators up to 40GHz.

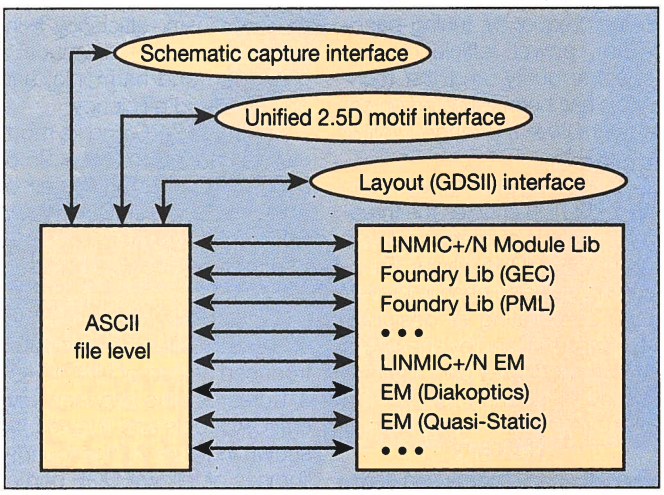

Figure 2: Links created between various CAD tools within the LINMIC+/N 4.1 interface from Jansen, developed under the European EDGE initiative.