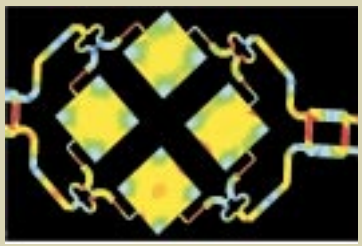
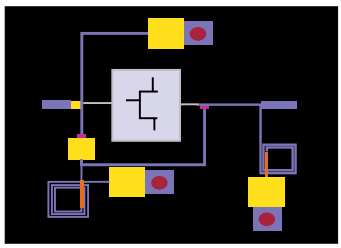
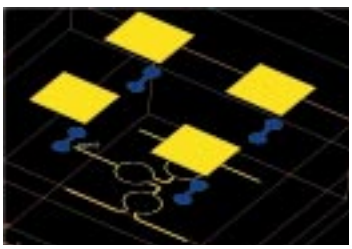
planar electromagnetic field simulator

ANSOFT Ensemble

planar EM simulation software for RF & wireless design

Ensemble is an electromagnetic simulation software package that computes s-parameters and full-wave fields for microstrip and planar microwave structures including filters, power dividers, and antennas. The Ensemble package includes a CAD layout front end, a simulation engine, and graphical post-processor for data display. The software eliminates traditional “cut-and-try” prototyping, reducing development costs and speeding time-to-market.

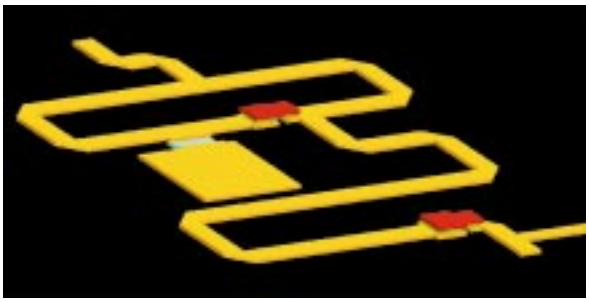


smart software for high-frequency design

Overview

Ensemble is a Method of Moments (MoM) simulation software package for the design and simulation of RF and wireless circuit and planar antennas. MoM lends itself well to layered media such as PCB, MMIC, and planar antenna structures. Ensemble allows designers to utilize the power of full wave planar simulation by offering an easy-to-use interface, advanced simulation features, and integration with other products in the Serenade Design Environment. Ensemble structures can come from Serenade circuit layouts, DXF input, or can be drawn with a powerful modeler that features point-and-click drawing, boolean unions, and measurement functions.



Microstrip traces and circuit elements

ensemble

Simulation Analyses

Ensemble's MoM simulation features bridge the gap between circuit analysis and electromagnetic analysis, whether the application is an MMIC circuit or a planar antenna array. The simulation analyses include:

- s-, y-, and z-parameters
- far field radiation
- near field radiation
- surface currents
- bistatic radar cross section

Ensemble Applications

- PCB trace and via simulation
- multilayer microwave packaging
- Microwave Integrated Circuits (MICs)
- Monolithic Microwave Integrated Circuits (MMICs)
- planar antennas and arrays
- circuit device library development

Graphical Features

- *estimate* command for initial design dimensions
- DXF and GDS input and output
- point-and-click drawing
- Smith chart, polar, and rectangular plots
- azimuthal far field plots
- zoom and pan on all plots
- read and write SuperCompact, Touchstone, and Citifile formats
- waveform calculator

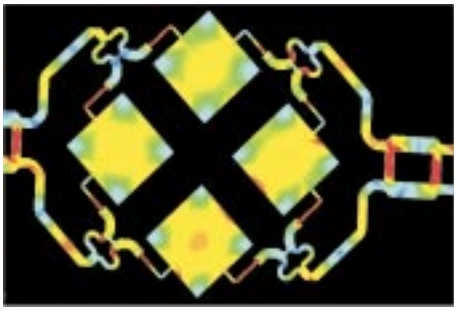
Flexibility

Ensemble's features make MoM simulation a more useful part of the design process. These features include:

- rapid frequency sweep
- black box circuit elements in MoM simulation
- simultaneous cavity and open formulation
- finite ground plane
- thick metal modeling
- internal ports
- adaptive meshing
- strip source deembedding
- thin film resistors

Antenna Design Features

- estimate of circularly polarized (CP) topology quantities
- far field plotting of right and left hand CP
- gain and axial ratio
- cross-pol and co-pol fields
- bistatic radar cross section (RCS)

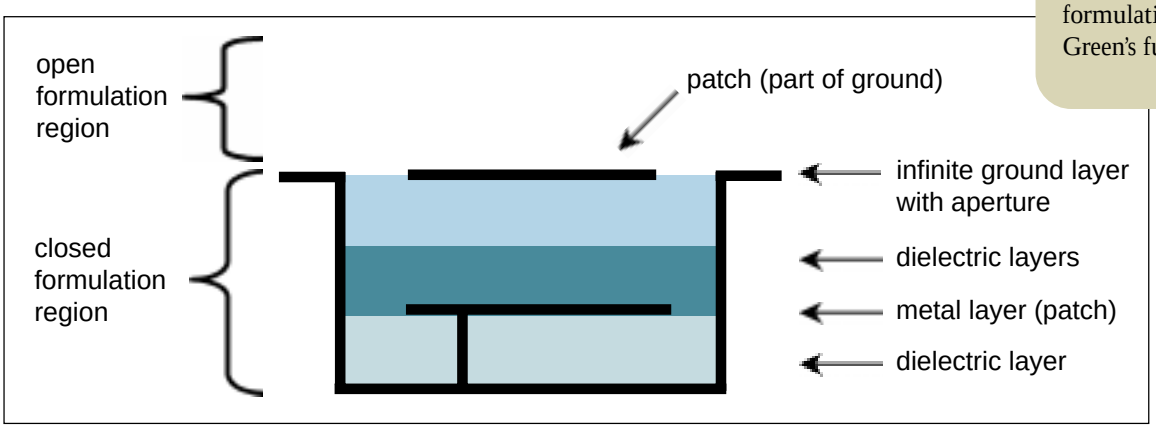


Animated surface current color plots

Simultaneous cavity & open formulations

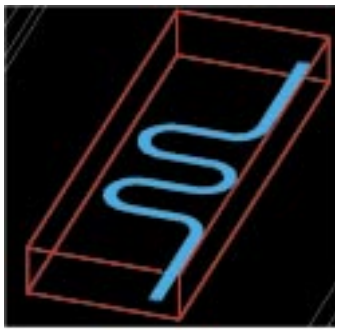
Ensemble users can choose between two different formulations of Green's functions for their simulations, open and closed. Closed (or cavity) formulations can be insightful, especially for circuits that are packaged in metallic housings; the open formulation works well with radiating problems such as antennas.

Cross section of a cavity backed patch antenna showing Ensemble's ability to simultaneously simulate an open and a closed formulation of Green's functions



Compare cavity & open formulations

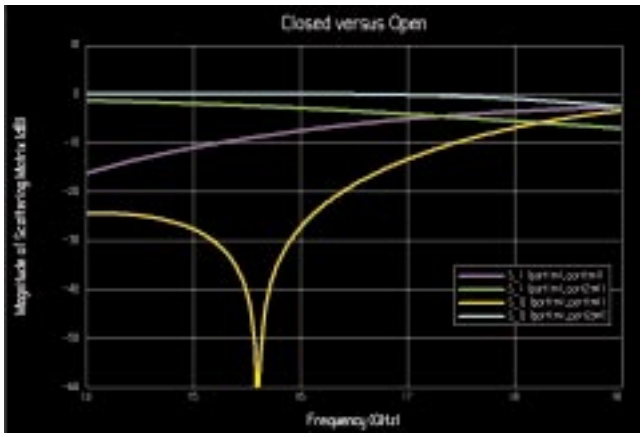
You can check your engineering assumptions by switching quickly and easily between cavity and open formulation simulations of the same structure, as demonstrated by this microwave low pass filter.



Closed formulation with enclosure

Open formulation

This output plot shows a comparison between an open formulation simulation and a cavity simulation of the microwave low pass filter above. The signals from the cavity simulation, in blue and red, exhibit significant resonances not exhibited in the open formulation simulation. Notice how plots from different simulations can be overlaid.



Typical Use Model

1 Use the *estimate* command for initial dimensions

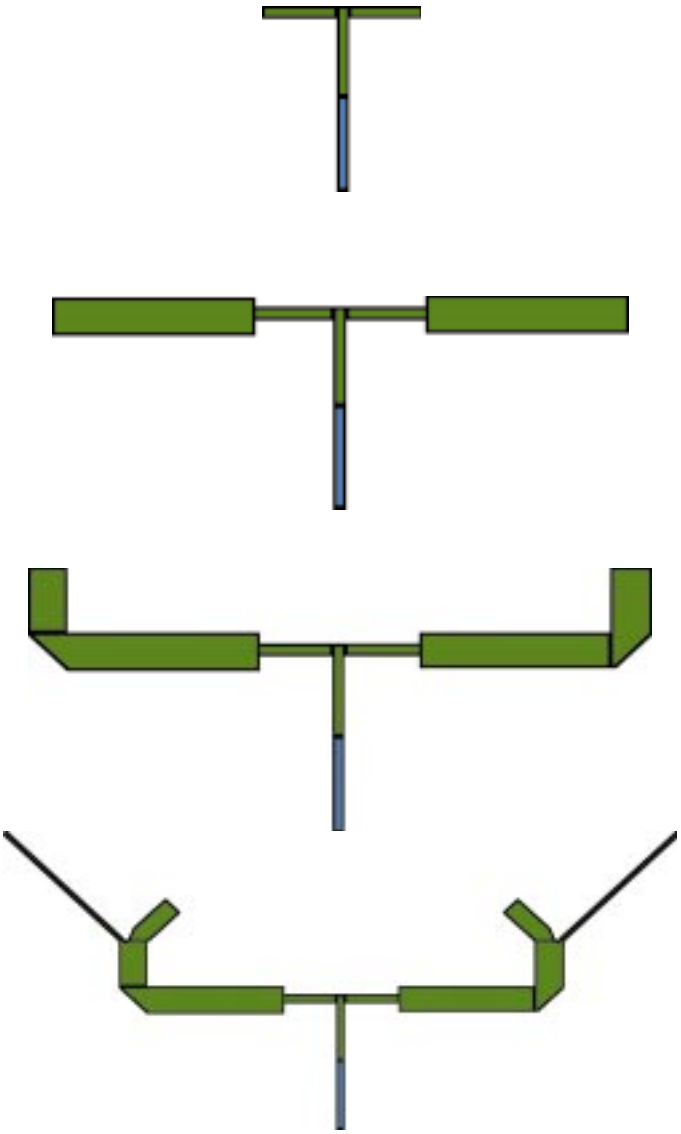
Ensemble's *estimate* command calculates initial dimensions for transmission line structures including quarter wave transformers, tuning stubs, and impedance width. Ensemble can estimate patch antenna dimensions inclduing resonant length, corner cut, and impedance location.

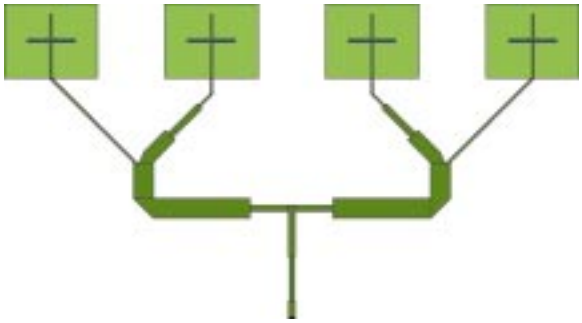
2 Simulate and measure each section

After estimating initial dimensions, you can simulate each additional section of the feed network with Ensemble, estimating and adjusting each section to get the correct amplitude, phase, and impedance match. At the end of this process even a complicated transmission line network is perfectly tuned for your design.

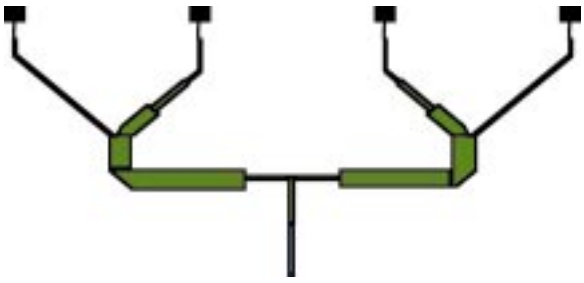
3 Use s-parameter black boxes to minimize simulation time

Ensemble makes this design process practical by allowing you to temporarily represent part of the structure by s-parameters rather than repeatedly simulating metal structures that do not change. In this antenna array example, the aperture coupled patch element was designed in Ensemble and its s-parameters were used for the frequency dependent black box.





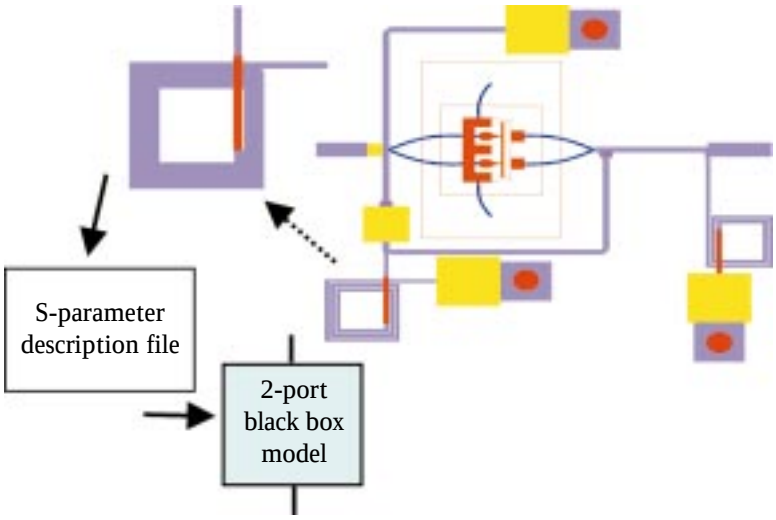
Complete 5.8 GHz multilayer aperture coupled antenna array



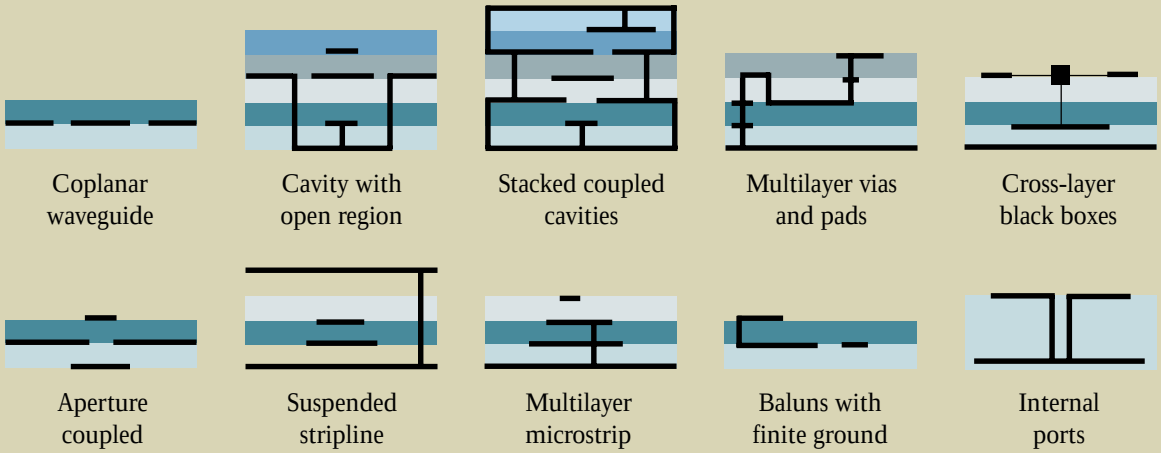
Array feed network with patch elements replaced by s-parameter black boxes to reduce simulation time during the feed network design process

Amplifier Design Using Ensemble

Ensemble allows users to include s-parameters of active devices (such as transistors and diodes) along with passive elements in the electromagnetic simulation. This enables you to simulate the complete layout of an amplifier (right). The simulation can be extremely efficient if the layout is partitioned, and individual elements like the spiral inductor are separately simulated to create behavioral building blocks for the overall simulation.



Ensemble simulates many structures practical for high-frequency design



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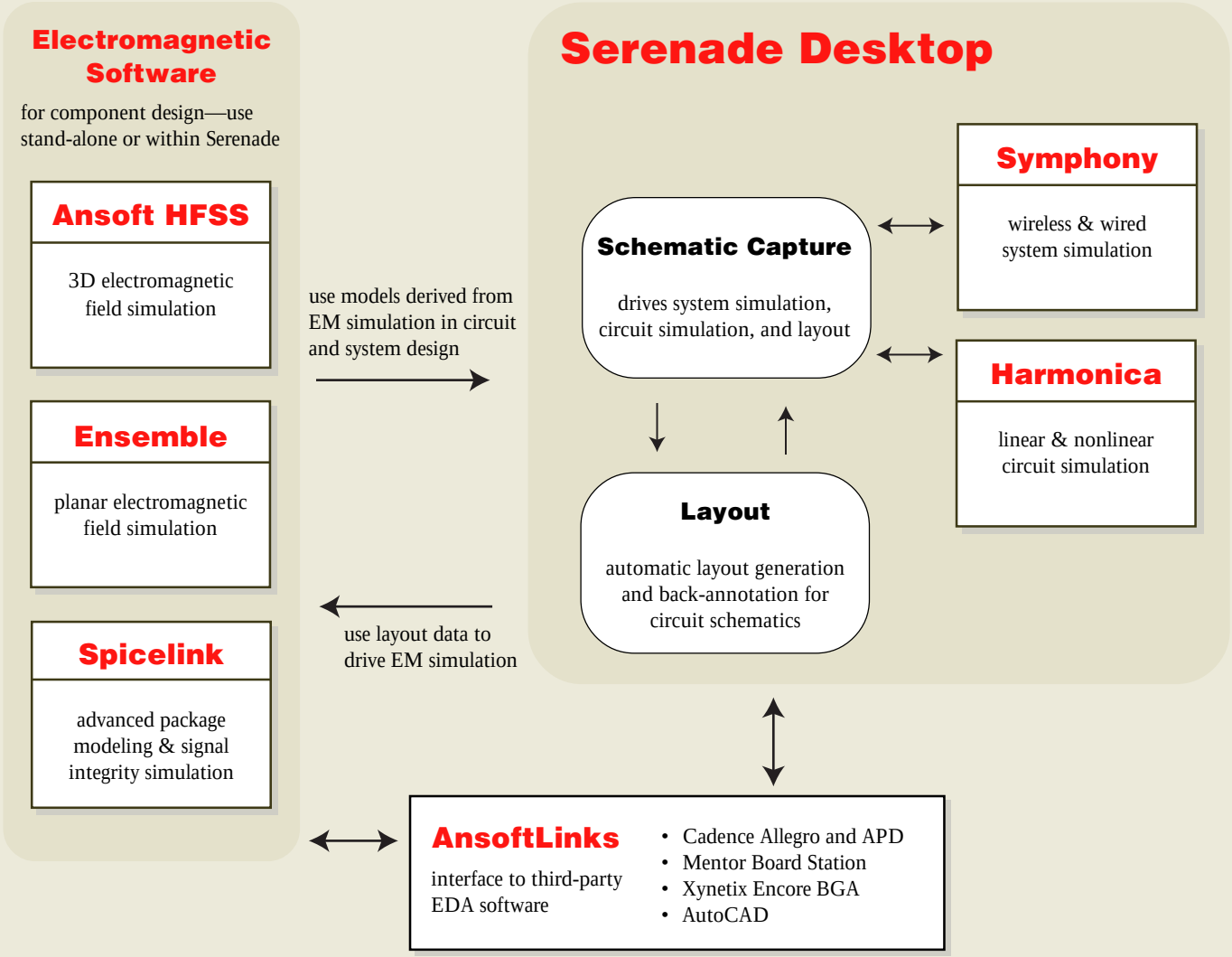
Your End-to-End Software Solution for High-Frequency Design



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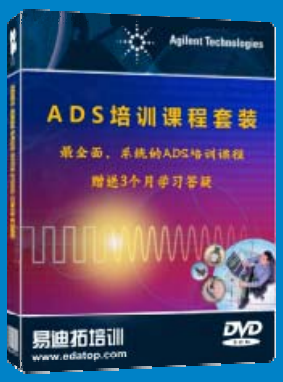

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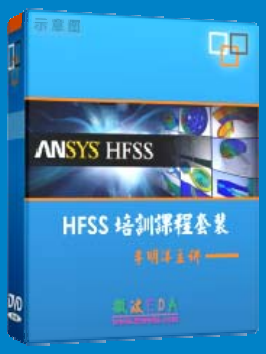

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