SOPRANO

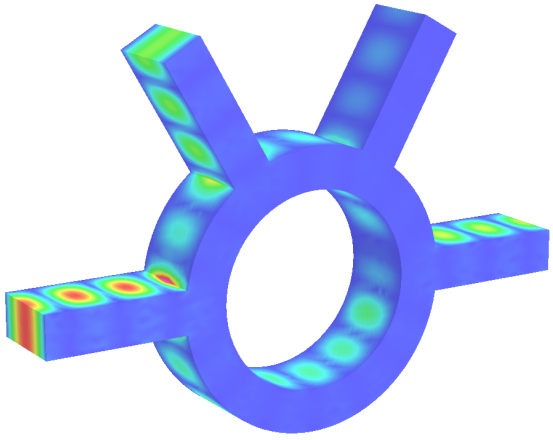
3D HIGH FREQUENCY EM ANALYSIS

The SOPRANO analysis package is a module of the OPERA-3d integrated suite of finite element software for 3D electromagnetic design and analysis. SOPRANO computes the response of high frequency electromagnetic devices in three dimensions, and is based on well proven advanced numerical methods for accuracy and speed of computation.

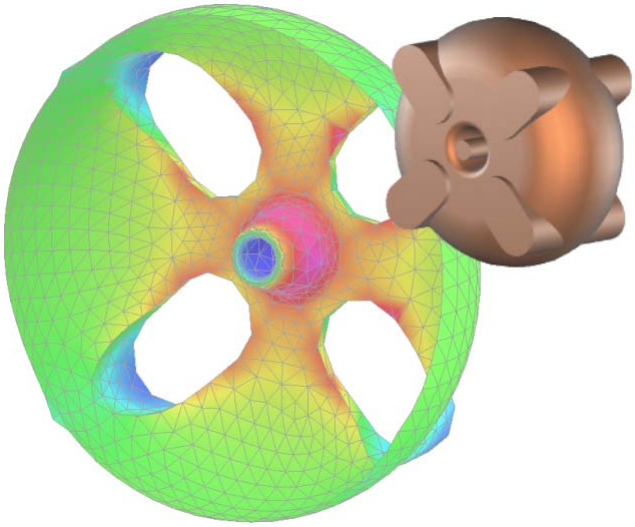
Concepts

In optimizing the design of electrical equipment the basic conceptual design needs to be based on proven analysis tools. Vector Fields is a specialist in electromagnetic design, and has built up an enviable reputation over many years for reliable, accurate and easy to use software for electrical and electronic engineers.

The complex computation of high frequency fields has been extensively researched, and the SOPRANO analysis module, together with the OPERA-3d Modeler and Post Processor package, offers a complete environment for this class of electromagnetic analysis and design.



Electric fields on surface of "rat race" circulator. The design still requires modifying to remove fields in the 3rd arm.



Surface current density on the inside of an RF cavity resonating at 340 Mhz

With the latest Vector Fields developments the analysis of electromagnetic fields has moved from the realms of specialist analyst to the main stream design process. Interfaces to major CAD packages enable the SOPRANO software to be integrated into an overall computer aided engineering system.

Applications

SOPRANO is designed to complement existing modules, by extending the frequency range to include propagation effects and the analysis of resonant structures. The experience of the Vector Fields development team and application engineers has produced a package that is easy to use for the design of a wide range of waveguide components, and resonant devices such as RF Cavities.

VECTOR FIELDS
Software for Electromagnetic Design
www.vectorfields.com

Method

SOPRANO uses specialist finite element analysis techniques for simulating the frequency domain fields, or the resonant modes (eigenvalues) of a structure. The equations are specially gauged to ensure that so-called "spurious" modes do not occur. For modal analysis, SOPRANO solves the real eigenvalue equation:

$$\mathbf{K}x = \lambda \mathbf{M}x$$

which can be solved to return one or more eigenvalues (λ), and their related eigenvectors (x). Boundary conditions can be applied to imply perfect conducting or magnetic walls, which can be used to impose symmetry in the model.

For eigenvalue problems, modeling re-entrant corners is crucial and special care has been taken to represent such features accurately. It is assumed that all conducting walls are ideal conductors (the losses in the wall are not taken into account) although the surface current distribution can be obtained by suitable post processing, as well as Q factor calculations. The post processor will also be able to display the eigenvectors associated with these resonant modes.

For frequency domain field analysis, the full Helmholtz equation is modeled, including loss and propagation terms. The complex solution can be further processed in the post processor to provide the results at any time in the ac cycle (including time average and RMS quantities).

Features

SOPRANO has the following features:-

- Full 3D modeling
- Automatic Mesh Generation
- Efficient data input
- Interfaces to CAD/CAM
- Eigenvalue analysis
- Generalized boundary conditions
- Extendable Post Processing

Modeler and Post Processing

As a module of the OPERA-3d suite of software, SOPRANO interfaces to the OPERA-3d Modeler and Post Processor. This gives the user access to powerful pre and post processing features specifically tailored for electromagnetic and cavity design.

The Modeler is specifically designed for electromagnetic applications by Vector Fields using the ACIS™ kernel. The Modeler has an easy to use 'windows' interface with clear icons. This enables complex 3D models to be constructed swiftly from primitive solids using Boolean operations and automatically meshed with tetrahedra. Transfer of geometric data between CAD systems and the Modeler is through the industry standard SAT and IGES file interfaces.

The post processor is renowned for its versatility in displaying computation results. It has very comprehensive and flexible facilities enabling the user to display the results in a variety of ways controlled by an easy to use 'windows' interface. The features include:

- 3D model views from any angle with mouse driven pan, zoom and rotation
- Graphs, histograms and contour maps of the solution, including eigenvectors
- Contours of the results on any surface
- Q factor calculations
- User defined functions

Hardware

All Vector Fields software runs on PCs and Workstations. It is Vector Fields policy to always support the latest operating system on each hardware. A list of supported hardware, and suggested minimum configurations, is available on request.

Customer Support

Applications advice and "hot-line" support is an integral part of the Vector Fields service. Professional engineers with extensive electrical design experience are available to help users in their application of SOPRANO. Your main Vector Fields office or local distributor will be pleased to be of assistance at all times.

Comprehensive user documentation is provided with SOPRANO enabling new users to quickly apply the software to their application. In addition, training courses are held regularly to give "hands-on" training in the use of SOPRANO.

User group meetings are held annually giving users the opportunity to discuss their applications with Vector Fields experts and other users in a relaxed atmosphere.

Whatever your application and wherever you are located, you can be sure of Vector Fields interest and support.

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