

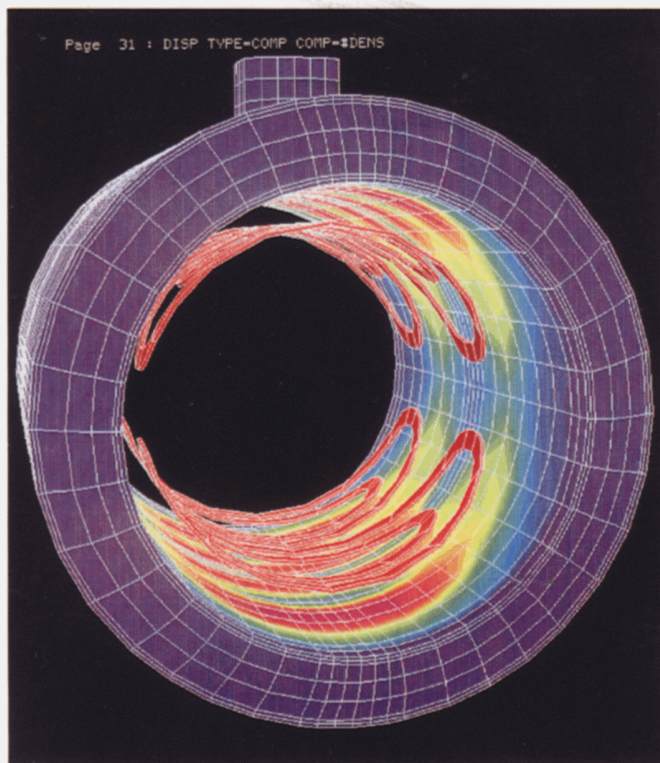
ELEKTRA

3D TIME VARYING EM ANALYSIS

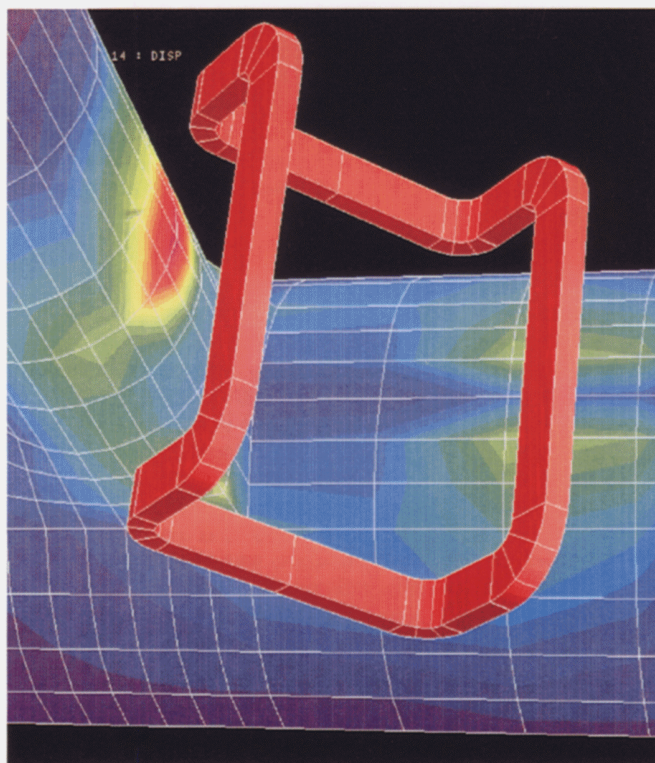
The ELEKTRA analysis package is a module of the OPERA-3d integrated suite of finite element software for 3D electromagnetic design analysis and simulation. ELEKTRA computes time varying fields, both time harmonic and transient in three dimensions and is well proven over many years of industrial use. ELEKTRA is a second generation package using advanced numerical methods for accuracy and speed of computation.

ELEKTRA has the following features:

- Full 3D modelling
- Efficient Data Input
- Time harmonic field analysis
- Transient field analysis
- High speed motion analysis
- Non linear materials
- Complex permeability
- Hysteresis effects
- Interfaces to CAD/CAM
- Extendible Post Processing



MRI body scanner gradient coils, showing current density on inner surface of cryostat



NDT inspection coil showing current density on surface of oil rig structure.

VF VECTOR FIELDS

SOFTWARE FOR ELECTROMAGNETIC DESIGN

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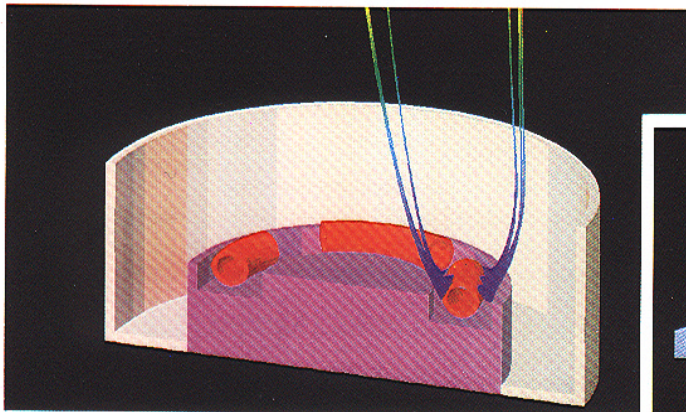
SCALA

3D SPACE CHARGE ANALYSIS

The SCALA analysis package is a module of the OPERA-3d integrated suite of finite element software for electromagnetic design and simulation. SCALA computes the effects of space charge on beams of charged particles in electrostatic fields, in three dimensions and is based on well proven advanced numerical methods to provide high accuracy.

The following features are included :-

- Full 3D modelling
- Electrostatic field analysis
- Space charge distribution analysis
- Relativistic particle and beam trajectory analysis
- Complex emitter geometry
- Multiple emitter geometry
- Choice of emission characteristics and laws
- Choice of particle characteristics
- Interface to CAD/CAM
- Extendible post-processing

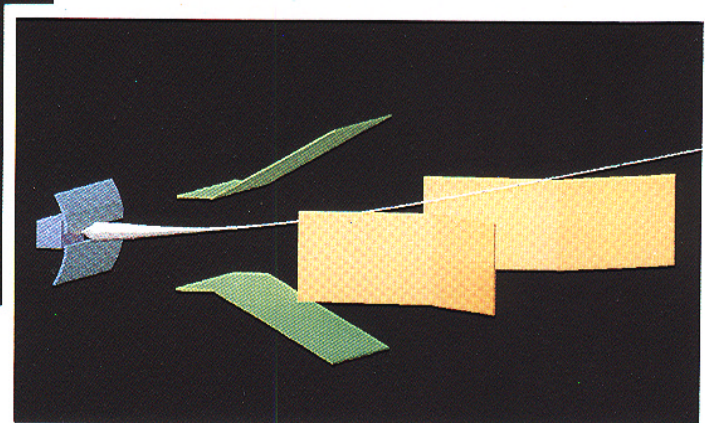


Rays from an Electron Gun

Applications

SCALA is designed to extend the range of 3d analysis modules provided by VECTOR FIELDS. The module addresses applications where high current charged particle beams pass through electromagnetic fields. The combined extensive experience of the application engineers and development team at VECTOR FIELDS has resulted in a versatile and easy to use package. Visualisation of the electromagnetic effects, in the particle beam trajectories, space charge distribution and electrostatic field stress provide detailed information on which design improvements may be based. Typical design and simulation applications include:-

- Electron guns and beams
- Ion guns and beams
- Field emission microscopes
- Beam analysis in
 - CRT display tubes
 - X-ray tubes
 - Electron lithography
 - Electron microscopes
 - Mass spectrometers
 - Heavy ion accelerators



Particle Beam in Cathode Ray Tube

VF VECTOR FIELDS

SOFTWARE FOR ELECTROMAGNETIC DESIGN

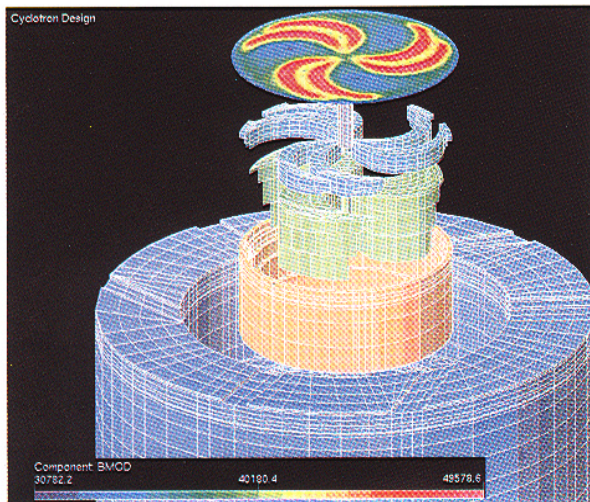
TOSCA

3D STATIC EM FIELD COMPUTATION

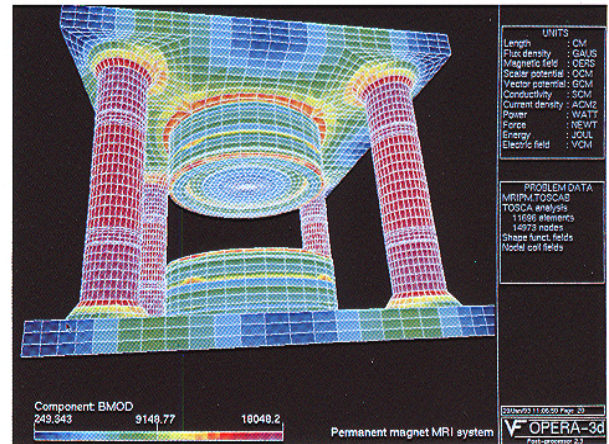
The TOSCA analysis package is a module of the OPERA-3d integrated suite of finite element software for 3D electromagnetic design analysis and simulation. TOSCA computes magnetostatic and electrostatic fields in three dimensions, and is well proven by over 12 years of industrial use. The package is renowned for its accuracy of computation which is the result of extensive research into advanced numerical methods.

TOSCA features the following:

- Full 3D modelling
- Electrostatic field analysis
- Magnetostatic field analysis
- Non linear materials
- Anisotropic materials
- Permanent magnets
- Conductors independent of F.E. mesh
- Interfaces to CAD/CAM
- Extendible Post Processing



Exploded view of a cyclotron showing flux density in the mid plane



Flux density on surface of steel in a permanent magnet MRI system

Applications

TOSCA is a pioneer in the use of finite element electromagnetic analysis techniques in three dimensions for the design of electrical equipment. Consequently the package is used extensively world wide by leading manufacturers, research laboratories and universities for the design of a wide range of devices from the smallest micromotor to the largest accelerator. The following list is a selection of some of the design applications for which TOSCA is being used:

- Motors
- Generators
- Recording Heads
- Electron Lenses
- MRI Systems
- Corrosion Protection
- Scientific Apparatus
- Electromagnetic Shielding
- Fusion Magnets
- Particle Accelerators

VF VECTOR FIELDS

SOFTWARE FOR ELECTROMAGNETIC DESIGN

Optimal design of electrical equipment requires the use of analysis software dedicated to electromagnetics. By using TOSCA and OPERA-3d designers have at their disposal many years experience accumulated by the VECTOR FIELDS team, renowned in industry and academia as leaders in electromagnetic computation. By using TOSCA to simulate the fundamental electromagnetic performance of a design, the design engineer can evaluate alternative approaches easily and quickly with confidence at the concept stage. This reduces or can even eliminate the need for expensive and time consuming pre-production prototypes.

Method

TOSCA uses a discrete finite element model in order to solve the partial differential equations governing the behaviour of electromagnetic fields. The TOSCA method computes the total potential in the magnetic material and the reduced potential in the regions where source currents have been specified. The reduced potential represents only that portion of the field produced by magnetisation, the remainder of the field being computed directly from source currents. By using this method TOSCA avoids the drawbacks of other methods which often produce cancellation errors. As a result, the accuracy of the TOSCA computation is far higher than alternative methods and is proven by over 12 years of comparison with measured results.

The magnetic material properties for TOSCA may be specified as non-linear, anisotropic or permanent magnet. The program uses an iterative solution technique for the matrix of linear simultaneous equations obtained for the potential at each node of the mesh, considerably reducing the memory requirements needed for a direct matrix solution algorithm. The TOSCA program employs a modified Newton-Raphson technique to successfully update the element permeabilities in order to obtain the fields with non-linear materials present.

The results from the program are created in a database for direct examination by the user. There is a brief summary of the data input to the analysis module and a record of the solution procedure. The analysis affords restart facilities which allows partially completed solutions to be restarted from the point at which they had previously stopped, additional results to be obtained without re-analysing, and previous solutions to be exploited when solving a problem with the same geometry, but, for example, different material properties.

Pre and Post Processing

As a module of the OPERA-3d suite of software, TOSCA interfaces to the OPERA-3d pre and post

processor. This gives the user access to powerful pre and post processing features specifically tailored for electromagnetic design including an advanced Graphical User Interface (GUI) with an easy to use menu system for data input and display of analysis results. Interfaces to industry standard CAD packages are also available.

The pre processor assists the user to create a 3D model of the device to be analysed, quickly and efficiently. Material data can be selected from a library of characteristics or input from the user's own data. The resulting input is fed directly to the TOSCA analysis module.

The post-processor gives the user facilities to display the results of the analysis in a number of ways including:

- 3D model views for any angle
- Graphs, histograms and contour maps of the solution
- Contours of the results on any surface
- Calculation of fields, forces and energy
- Particle tracking
- User defined functions

Hardware

UNIX Workstation or VAX/VMS having the following minimum configuration:-

- Memory 8Mb minimum 16Mb preferably
- Hard Disk 320Mb
- Tape Drive Industry Standard or Cartridge
- Monitor Colour preferred

Special versions are also available for IBM and Cray mainframes. A full list of supported hardware is available on request.

Customer Support

Application advice and "hot-line" support is available from VECTOR FIELDS offices and distributors. Professional engineers with extensive electrical design experience are available to assist users in their application of TOSCA.

Training courses are held regularly to give "hands-on" training in the use of TOSCA.

User group meetings are held annually to give 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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