Defining antenna performance

TICRA ENABLES YOU TO CREATE, ANALYSE AND VALIDATE ANTENNA DESIGNS FASTER AND MORE ACCURATELY.

TICRA

Trusted antenna and EM modelling software

It is crucial that your antenna designs can be optimized and validated in the shortest possible timeframe. That's why our antenna and EM modelling software is trusted by every major player in the global satellite market.

TICRA is the leading provider of cutting-edge antenna modelling software for spacecraft operators and manufacturers, space agencies, earth station suppliers, defence organisations and research institutions.

Based in Copenhagen, Denmark, and with agents around the world, TICRA's products are trusted worldwide as the reference standard for reflector antenna design and analysis.

A history of excellence

TICRA was founded in 1971 to develop ways to accurately describe electro-magnetics phenomena, such as radiation from satellite antennas. In 1976, TICRA created GRASP, the world's first commercial reflector antenna code, which has since evolved to become the fastest and most effective tool for reflector antenna modelling and scattering analysis.

Building on this heritage, TICRA today offers a broad range of products and consultancy services that enable businesses to streamline their development process, providing absolute confidence that each antenna design will be fully validated and truly optimized for its specific use.

TICRA IS THE LEADING PROVIDER OF CUTTING-EDGE ANTENNA MODELLING SOFTWARE FOR SPACECRAFT OPERATORS AND MANUFACTURERS, SPACE AGENCIES, EARTH STATION SUPPLIERS, DEFENCE ORGANISATIONS AND RESEARCH INSTITUTIONS.

TICRA Tools

SEAMLESS INTEGRATION OF ANTENNA ANALYSIS AND DESIGN TOOLS

Whether you work with large radio telescopes scanning the universe, complex satellite antennas enabling communication between all parts of the earth, or the small terminals that ensure cruise passengers always have internet access, you rely on being able to simulate the antenna performance in the early design phase, during manufacturing and even after implementation.

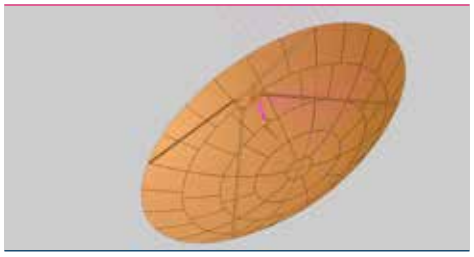
TICRA Tools offers a range of products with a proven track record you can trust to accomplish your daily analysis and design optimization tasks. The applications range from reflector antennas in GRASP over general antenna and scattering analysis in ESTEAM to feed horns and waveguide components in CHAMP 3D, as well as surfaces composed of frequency and polarization-sensitive materials in QUPES.

TICRA Tools

www.ticra.com/ticratools

GRASP

FAST AND ACCURATE DESIGN AND ANALYSIS OF COMPETITIVE REFLECTOR ANTENNA SOLUTIONS

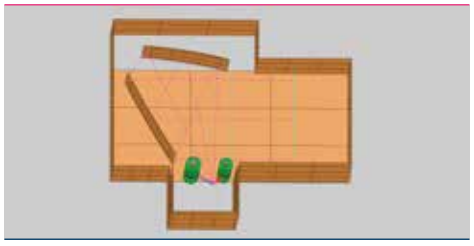


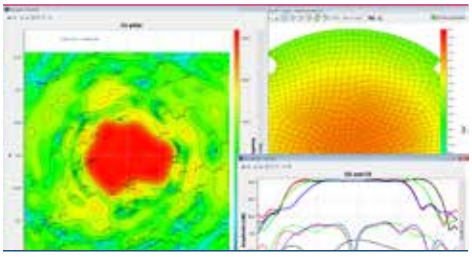
Analysis and design of reflector antenna systems

GRASP is a dedicated software package for reflector systems and as such, it offers fast and accurate analysis and design optimization even of the most advanced reflector antenna systems. The efficient Physical Optics algorithm that GRASP is based on enables users to predict the entire pattern from very large antennas in a matter of seconds. Ray methods are also available as an alternative and may be used to visualise scattering paths.

Easy definition of single and dual reflector geometries with built-in wizard

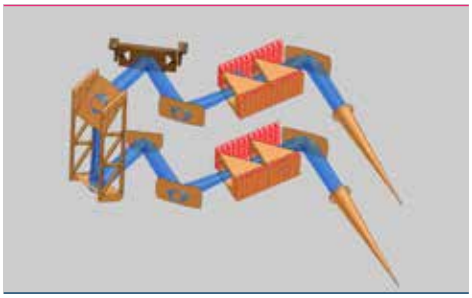
The intuitive wizard in GRASP allows for easy setup of single reflectors, Gregorian and Cassegrain systems as well as axially displaced dual reflectors. The wizard generates a template that can serve as a starting point for more elaborate investigation of antenna designs.





Large selection of feed models

Analytical feed radiation patterns as well as import from other analysis tools or measurements are supported. The most accurate predictions are obtained in conjunction with CHAMP 3D in TICRA Tools, which also enables design optimization based on secondary far-field goals.



Quasi-optical network design

The GUI enables easy setup of beam-waveguides and quasi-optical networks consisting of feeds, plane and curved mirrors, beam-splitters, interferometers and loads. These networks are first designed and sized by means of Gaussian beam theory, and may subsequently be analysed by PO, which offers accurate determination of de-polarization and diffraction effects.

www.ticra.com/grasp

FEATURES

- *Wizard for easy definition of single and dual reflector geometries*
- *Near-field and far-field calculations of vector fields*
- *Component library for common geometries, e.g. conic surfaces, general quadrics, radomes, panels, rectangular and circular struts*
- *Import of general reflector shapes from file*
- *Component library of mathematical feed models*
- *Import of general feed definitions from file and expansion in spherical modes*
- *Easy definition and fast analysis of quasi-optical networks*
- *Fast and easy computation of power transmitted between two antennas*
- *Advanced GTD algorithm for large reflector and scattering problems*
- *Design tool for quasi-optical network*
- *Library of commonly used quasi-optical components*

BENEFITS

- *Seamless integration with products in TICRA Tools*
- *Accurate analysis of reflectors*
- *Reliable results*
- *Increased productivity through efficient project file handling*
- *Easy to import feed data from other software vendors or test ranges*
- *Quick setup of complicated geometries*
- *Guided design of quasi-optical networks*

ESTEAM

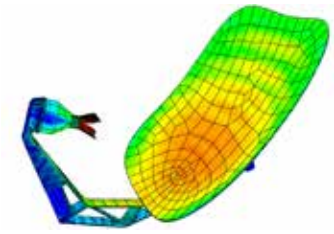
DESIGN OF GENERAL ANTENNAS AND SCATTERING BY LARGE STRUCTURES

FEATURES

- *State-of-the-art higher-order MoM solver*
- *MLFMM implementation tailored to higher-order MoM*
- *Automatic meshing of imported CAD files*
- *Selection of parametrised geometries, including wires, boxes, BoR and clusters of any of these*
- *Waveguide ports, generators and measured patterns as excitations*
- *Analysis of structures with composite metallic, dielectric and magnetic materials*

BENEFITS

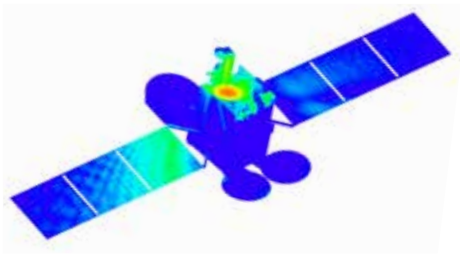
- *Seamless integration with GRASP and CHAMP 3D in TICRA Tools*
- *Design, analysis and validation of complex antenna installations*
- *Higher accuracy and lower memory requirements than competing full-wave solvers*
- *Analysis of highly detailed models, providing better comparison with measurements*
- *Confidence in your design*



General EM scattering and radiation
ESTEAM is the tool for solving electromagnetic scattering and radiation problems of general nature involving conducting as well as dielectric materials. The true strength of ESTEAM is clear when analysing electrically large systems such as an entire spacecraft with a multitude of reflector antennas, solar panels, thrusters and other mechanical structures representing a challenge to the performance of the installed antennas.

Minimum memory requirement, maximum accuracy
The secret lies in decades of in-house R&D in MoM techniques using higher-order patches and current expansion functions combined with an accelerated method, MLFMM, tailored to the MoM algorithm. This ensures maximum accuracy with minimum memory consumption, while simultaneously achieving high speed.

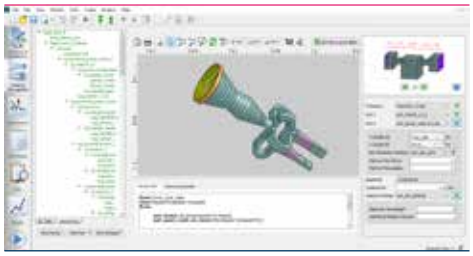
Flexible handling of complex geometrical models
Parametrised objects are available to build models of various geometries and antennas, and if combined with GRASP in TICRA Tools, a wide range of parametrised reflector geometries are also available. More complex structures may be imported through CAD files in STEP or IGES format or through tabulated mesh files. When combining electrically connected geometries from multiple sources, ESTEAM automatically stitches the meshes together – the user does not need to manually ensure mesh connectivity.

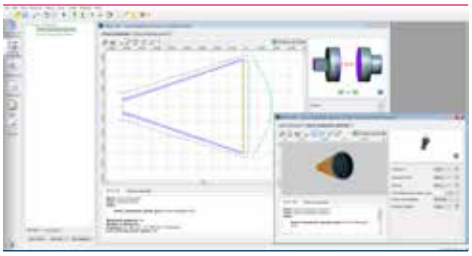


www.ticra.com/esteam

CHAMP 3D

ANALYSIS AND DESIGN OF PASSIVE WAVEGUIDE COMPONENTS AND COMPLEX FEED CHAINS





Built-in library of predefined components

In CHAMP 3D the user can build a complex 3D or rotationally symmetrical waveguide assembly or feed by selecting from a library of predefined components or load the assembly/component from a CAD file. Scattering parameters and radiation from feeds excited by arbitrary waveguide modes or any combination hereof can be calculated.

The components are analysed with the most appropriate solver, tailored to each component.

Simple setup of rotationally symmetric horns

The dedicated 2D editor, known from CHAMP, can be used for easy setup of axially or radially corrugated horns, smooth-wall horns as well as rotationally symmetric reflectors and VSATs.

Easy design optimization

The optimization algorithms available for any product in TICRA Tools offer both global and local methods for thorough design developments. S-parameters and return loss are typically considered in CHAMP 3D, just as the feed pattern may be formed to meet a specific illumination pattern. Rotationally symmetric terminals with one or two reflectors can be made to meet patterns constraints, e.g. side-lobe roll-off.

In conjunction with GRASP in TICRA Tools it is possible to optimize all the feed chain components in general antenna systems based on the final desired far-field performance rather than a prescribed intermediate pattern.

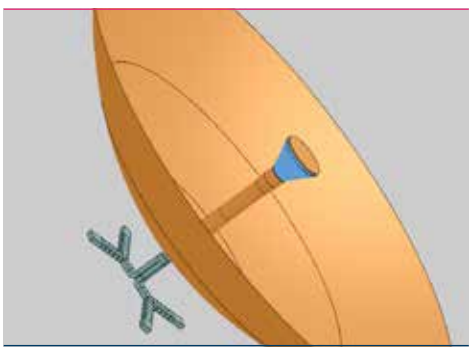
www.ticra.com/champ3d

FEATURES

- *Calculate scattering parameters for passive metallic and dielectric waveguide components*
- *Calculate reflection coefficients/ scattering parameters and radiation patterns for rotationally symmetric and arbitrarily shaped feeds*
- *Fast recalculation of waveguide assemblies by use of the Generalized Scattering Matrix (GSM) approach for decomposing the assembly into smaller components*
- *The most appropriate solver (analytical expressions, mode matching, higher-order BoR-MoM, or higher-order 3D MoM) is selected for each component*
- *Dedicated wizard and 2D editor, known from CHAMP, for easy geometry setup of corrugated horns, smooth wall horns as well as rotationally symmetric single, dual, and ring focus reflectors*
- *Direct optimization with goals on scattering parameters as well as primary and secondary radiation patterns*

BENEFITS

- *Seamless integration with products in TICRA Tools*
- *Accurate analysis, guaranteeing agreement between predictions and measurements*
- *Feeds, waveguides, and reflectors can be analysed and optimized as a single model*



QUPES

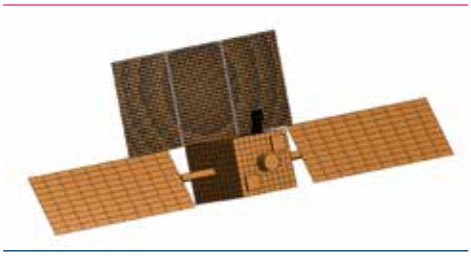
ANALYSIS AND DESIGN OF QUASI-PERIODIC SURFACES

FEATURES

- *Analysis and optimization of scattering parameters of periodic unit-cell structures*
- *Predefined library of commonly used geometries*
- *Dedicated methods for the analysis of periodic/quasi-periodic surfaces*
- *Features for multiple panels, holes, planar and curved surfaces*
- *Large-scale direct optimization of quasi-periodic surfaces for goals on primary as well as secondary radiation patterns*

BENEFITS

- *Fast and accurate analysis of periodic/quasi-periodic surfaces*
- *Design of quasi-periodic surfaces in a single tool*
- *Provides designs with superior performances compared to traditional methods*
- *Can handle real-life applications*



Analysis and design of quasi-periodic surfaces

QUPES is a dedicated software tool for the analysis and design of quasi-periodic surfaces such as reflectarrays, frequency selective surfaces (FSS), transmitarrays, etc. Starting from the definition and design of the unit-cell geometry to the optimization of the entire finite-sized structure, QUPES provides the needed capabilities to design a periodic/quasi-periodic surface in a single tool, thus avoiding the need of using multiple software packages.

Unique capabilities for the design of quasi-periodic surfaces

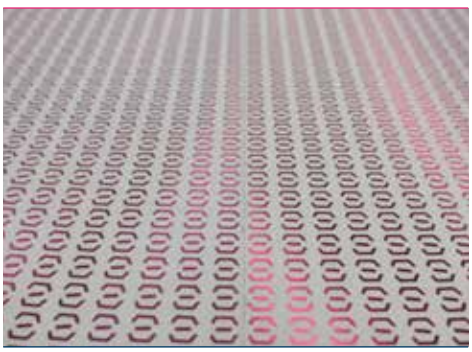
The product is a result of several years of research and contains unique capabilities that are not available in any other commercial software packages. In particular, the capability of optimizing entire quasi-periodic surfaces directly for goals on the final radiation pattern has proven to be the enabling technology for achieving high-performance designs.

Seamlessly integrated with TICRA Tools

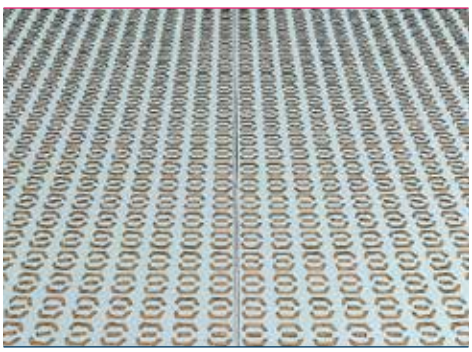
The capabilities in QUPES are seamlessly integrated together with the other software products in TICRA Tools, meaning that you can have access to all the existing functionalities in TICRA Tools together with the capabilities in QUPES. For instance, this allows the user to design advanced high-performance reflector systems consisting of periodic/quasi-periodic surfaces.

Note: QUPES will be released in 2019.

Close-up of physical antenna

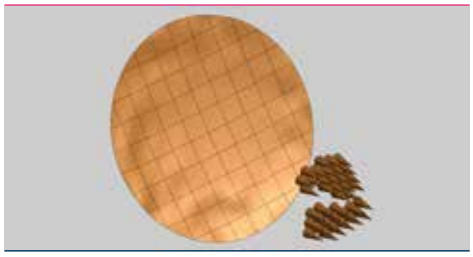


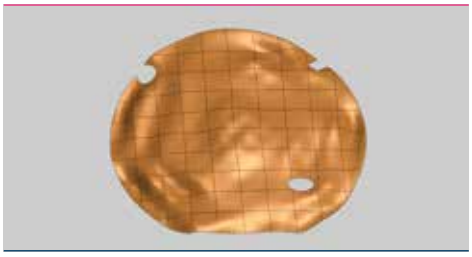
Close-up of simulated antenna in QUPES (software)



POS

ADVANCED PAYLOAD ANTENNA DESIGN SOFTWARE

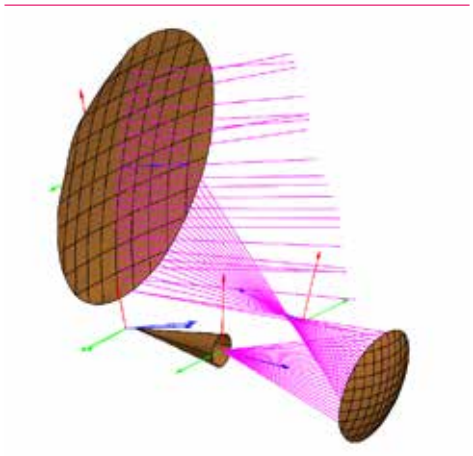




POS is tailored to design antennas with a prescribed radiation pattern for advanced satellite payloads, particularly highly contoured beams. The software is used for reflector surface shaping, array coefficient optimization in multi-feed reflectors, and for optimizing array coefficients in direct radiating arrays.

Optimization of single, dual and multiple reflectors

POS allows simultaneous optimization of all surfaces in single, dual or multiple reflector systems and, if applicable, the excitation coefficients of the feed array. Direct radiating arrays may also be designed.



Consideration of realistic design constraints

Cut-out regions and through-holes in the reflectors are often imposed for accommodation purposes and are important to account for in the early phase of a shaped reflector design. Consequently, the reflector definition in POS allows for a very general description of these characteristics. To ensure that the final surface is manufacturable, restrictions on the curvature can be imposed as side-constraints to the design optimization.

Reduced runtime with minimax optimizer

An accurate and efficient Physical Optics algorithm is used to establish the goals for an optimization procedure. The Physical Optics and the advanced minimax algorithm significantly reduce the runtimes required for optimization of systems with a large number of variables, stations and/or constraints.

Note: POS will be included in TICRA Tools in a future release.

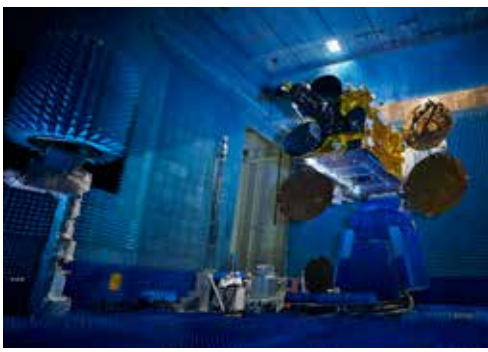
www.ticra.com/pos

FEATURES

- *Single, dual or multiple reflector shaping*
- *Optimization of array excitation coefficients*
- *Various surface shaping expansion functions*
- *Control of maximum surface curvature for manufacturability*
- *Consideration for manufacturing-imposed constraints in the design phases*
- *CAD export of shaped reflector surface*

BENEFITS

- *Tailored PO algorithm and minimax optimizer ensures extremely fast reflector design*
- *Highly accurate analysis during optimization*
- *Thoroughly tested by the space industry for decades*
- *Compatibility with GRASP to easily subject shaped reflector designs to thorough performance evaluation*
- *De facto industry standard for contoured beam reflector antenna design*



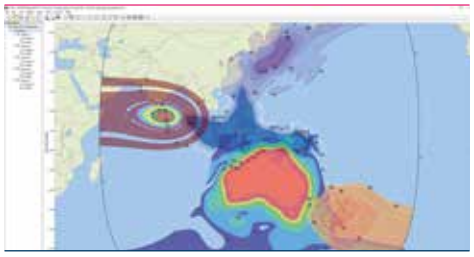
Mission planning and analysis

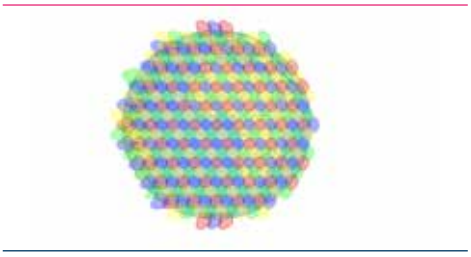
The earth seen from space is a key visual when planning future satellite services; being able to select the intended service regions or countries should be no further away than a mouse-click.

SATSOFT offers this capability, combined with numerous options for generating and displaying antenna patterns to fulfill performance requirements. Equipped with a customisable database of cities on the globe, performance tables are easily generated to thoroughly inspect the performance of a given satellite antenna anywhere in the service area. Both service providers and antenna designers will benefit from the intuitive GUI offering vast antenna pattern display capabilities.

SATSOFT

EASY ASSESSMENT OF ANTENNA COVERAGE AND GAIN, DEVELOPMENT OF CONTOURED BEAM AND MULTI-BEAM ANTENNA DESIGNS





SATSOFT is designed for communication satellite antenna design, analysis and coverage planning.

Synthesised contoured and multi-beam antenna designs
Users can synthesise antenna beams using different antenna models. The fast mini-max optimizer in SATSOFT quickly converges from an initial starting point to an optimum solution allowing you to evaluate the performance in detail.

Increased productivity with easy data export to other TICRA programs
With SATSOFT, you can easily export station files to be used for optimization in POS. And optionally, it is possible to export complete reflector configurations set-up in SATSOFT for further optimization in POS or analysis in GRASP, speeding up the design workflow considerably.

Exchange data with Google Earth
SATSOFT supports KML format for exporting data contours, giving you the ability to easily exchange data with Google Earth and take advantage of its rendering capabilities.

Prepare Earth station performance tables
SATSOFT offers detailed analysis of the antenna performance in specific directions, for example, longitude and latitude coordinates, cities selected from a database, and more.

Shaped reflector design
Preliminary designs of shaped reflectors can be made with the optional physical optics module, which can also be applied to single-feed and array-fed parabolic reflectors to enhance prediction accuracy.

www.ticra.com/satsoft

FEATURES

- *Quickly create polygons to use as coverage area definition*
- *Synthesise contoured and multi-beams with or without pointing error from reflector or array antennas*
- *Plot pattern contours and create performance tables of directivity, EIRP, and G/T*
- *Import measured or predicted antenna patterns to use in your analysis*

BENEFITS

- *Efficient planning, designing and marketing of communication satellite payloads*
- *Conduct antenna trade-off studies*
- *Prepare documents for ITU regulatory filings*
- *Intuitive user-interface*
- *Easy interface to POS and GRASP*

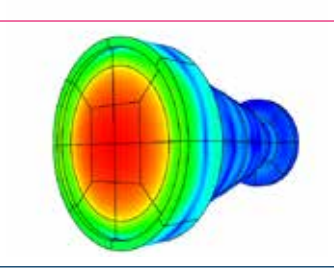
Measurement systems and software

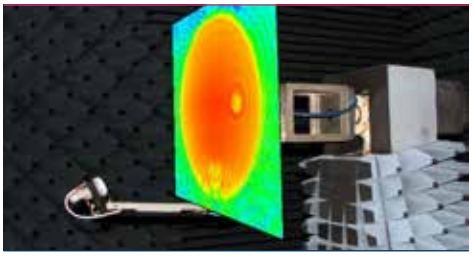
Inevitably, all antennas will eventually need to go through a validation test phase. The most complete test range is the spherical near-field, with a subsequent transformation of the data to the far-field. SNIFT's claim to fame is the field transformation including probe-correction, which accounts for the probe pattern and cross-polarization characteristics, and has been the tool of choice for more than four decades.

If the measured data deviates from the predictions, it is often easier to identify the cause of the discrepancy by inspecting the extreme near-field of the antenna. To this end, we developed DIATOOL, which accurately reconstructs this field from the measurements.

DIATOOL

DIAGNOSTICS TOOL TO INVESTIGATE YOUR ANTENNA'S FUNCTIONALITY FROM MEASUREMENTS





DIATOOL for advanced near-field test ranges

To assist test-range staff and antenna designers in identifying the origin of possible discrepancies in the designed and measured far-field patterns, DIATOOL works with the measured complex data (amplitude and phase) to view currents on the AUT or on a surface enclosing the antenna.

This procedure helps engineers to accurately reconstruct the extreme near-field and surface currents of an antenna under test (AUT) from the radiated field measured in anechoic chambers. The inspection of the extreme near-field and currents allows quick identification of electrical or mechanical errors in the antenna, which cause anomalies in the measured field, saving valuable time and resources in the antenna design and validation process.

FEATURES

- *Reconstruct the extreme near-field with a resolution better than half a wavelength*
- *Alternative methods: planar reconstruction for fast analysis of large antennas; inverse MoM for higher resolution*
- *Definition of the AUT geometry by CAD or mesh file import*
- *Automatic generation of reconstruction surface through best-fit canonical surfaces, CAD or mesh files*
- *Visualisation of reconstructed currents over AUT surface*
- *Compatible with most near-field and far-field range data formats*

BENEFITS

- *Early detection and location of antenna anomalies*
- *Remove noise from measurements by filtering*
- *User-friendly interface*

SNIFT

SPHERICAL NEAR-FIELD FAR-FIELD TRANSFORMATIONS WITH FULL PROBE CORRECTION

SNIFT is the indispensable software constituent in spherical near-field test ranges, with the primary function to perform fast and accurate transformation of an antenna's field from one imaginary spherical surface to another, with the far-field sphere being a special case.

FEATURES

- *Allows full sphere or partial sphere input data*
- *Full correction for rotationally symmetric (m=±1) probes*
- *Fast Fourier Transformation and self-stabilising recurrence relations allow handling of even very large antenna structures*
- *Industry standard for spherical near-field to far-field transformation with probe correction*
- *Independent of the actual measurement system implementation*

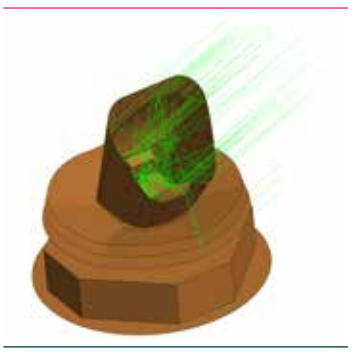
BENEFITS

- *Fast transformation time*
- *Mathematically exact pattern transformation*
- *The output coordinate system may be rotated to coincide with the peak direction of the far-field, which is not always coinciding with any of the measurement coordinate system axes*
- *Non-Maxwellian measurement inaccuracies are averaged to physically correct output*
- *Noise reduction by means of high-order spherical mode filtering*

Services and support for your antenna design and analysis task

Whether you need consultancy assistance, product training or you have support questions, our services and support team will assist you in all issues regarding antenna design and analysis applications.

To ensure maximum uptime for our customers, our skilled experts strive to deliver the best possible service and support. They are deeply involved in the ongoing development of the software, and they all have profound experience with all TICRA software from their comprehensive work as consultants and researchers. As such, they are committed to respond promptly and provide high-quality service and support to customer requests.



Services
To help you achieve fast and accurate reflector antenna design, we have a skilled team of engineers available to assist with your engineering tasks as well as product training.

Consultancy
Whatever antenna design and analysis challenges you face, we are committed to resolve them quickly and effectively. Our skilled team of engineers can assist with, for example, reflector systems and VSAT design and analysis, feed horn design and scattering analysis as well as reflectarray and FSS design.

Training
TICRA offers software training tailored to meet your specific needs. For new employees, training can help shorten the learning curve considerably, and for specialists, training offers the opportunity to keep up with the latest technology.

Technical support
All new software licenses include one year of Technical Support and Maintenance. This service includes expert help in the use of the software with 24 hours response time from Monday through Friday, as well as immediate access to new features and enhancements when a new software version is released.

Technical Support and Maintenance contract

Our Technical Support and Maintenance (TSM) contract keeps your EM software up to date and provides access to technical support by our experts when you need it.

All new software licenses include one year of TSM, which provides the following:

- Access to the newest functionality
  Our antenna engineering experts constantly develop new functionalities to improve the user interface of the software based on customer feedback and industry needs. Therefore, you get immediate access to updated features and enhancements when a new software version is released.

- Support with priority
  With a TSM contract you have access to experts who will provide technical user support when you need it, to help you run processes efficiently.

TO ENSURE MAXIMUM UPTIME FOR OUR CUSTOMERS, OUR SKILLED EXPERTS STRIVE TO DELIVER THE BEST POSSIBLE SERVICE AND SUPPORT.

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