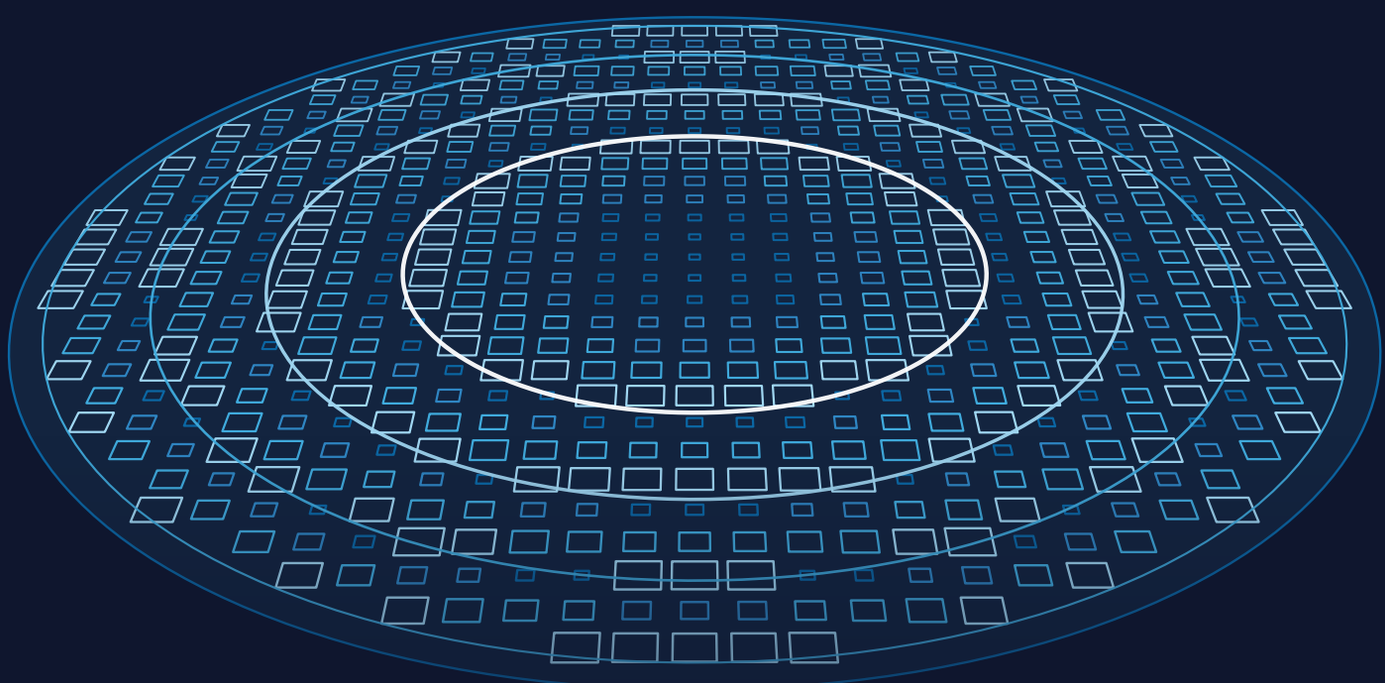
TICRA

QUPES

Direct optimisation of reflectarrays, frequency selective surfaces and transmitarrays: design quasi-periodic surfaces for the final radiation pattern, from unit cell to full antenna.



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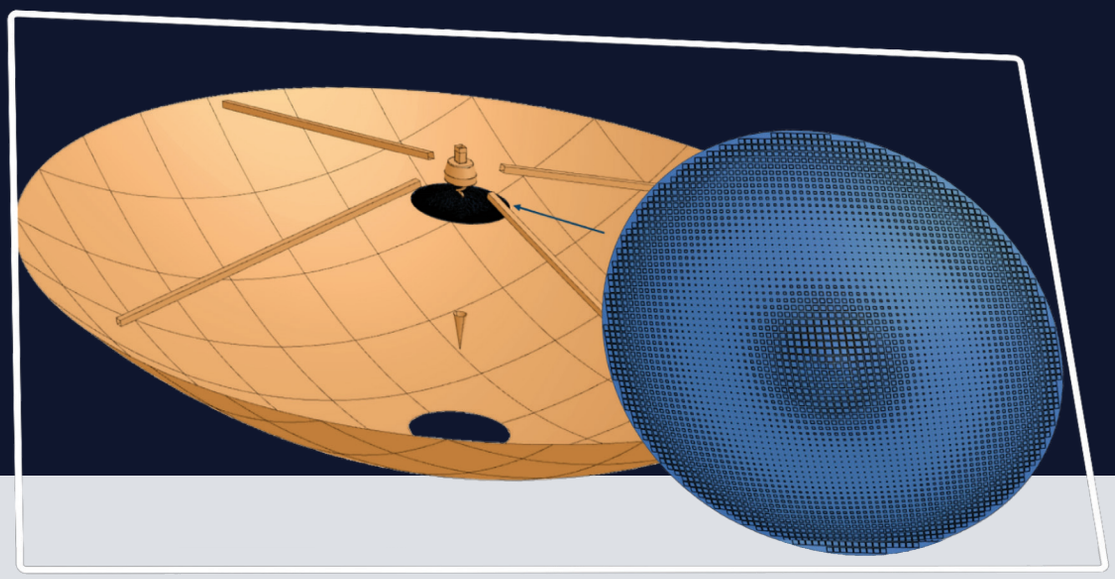


Design Quasi-Periodic Surfaces with Confidence

Reflectarrays, frequency selective surfaces (FSS) and transmitarrays focus, filter and shape radiation with passive, planar and lightweight structures. They are used in CubeSat and SmallSat payloads, high-throughput satellites, synthetic aperture radar, multi-band reflector systems and terrestrial 5G/6G.

Their performance depends on the geometry of thousands of unit cells, each with its own electromagnetic response.

QUPES is TICRA's dedicated software for this task. It combines a built-in unit-cell library, dedicated periodic and quasi-periodic analysis methods, and large-scale direct optimisation in a single tool.

QUPES optimises for goals on the primary and secondary radiation patterns, enabling engineers to design for mission performance rather than a prescribed intermediate phase distribution.

From unit cell to complete antenna surface

PRODUCT CAPABILITIES

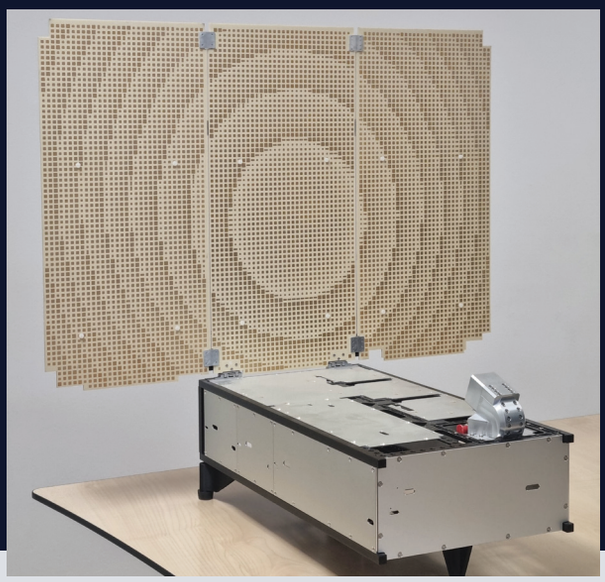
- Analyse and optimise scattering parameters of periodic unit-cell structures
- Define unit cells quickly from a built-in library of common geometries
- Model reflectarrays, FSS and transmitarrays with dedicated quasi-periodic methods
- Handle multiple panels, holes, and planar and curved surfaces
- Optimise complete surfaces directly for primary and secondary radiation-pattern goals

KEY TECHNICAL HIGHLIGHTS

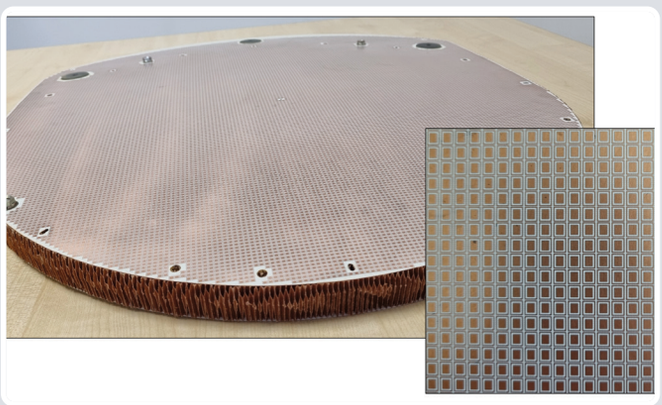
- Direct optimisation of tens of thousands of surface variables
- Unique capability not available in other commercial software
- Unit-cell definition to full-surface design in a single tool
- Superior performance compared to traditional design methods
- Agreement with RF measurements on flight-representative hardware
- Seamless integration with TICRA Tools

Why QUPES and TICRA?

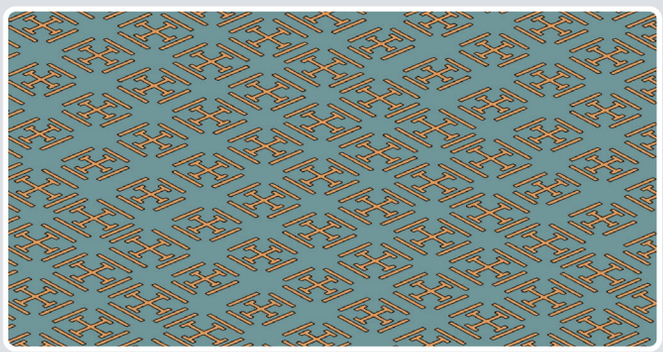
Developed from more than a decade of TICRA research, QUPES optimises entire quasi-periodic surfaces, with tens of thousands of variables, directly against goals on the final radiation pattern. This capability is not available in any other commercial software.



Ka-band deployable reflectarray for an 8U CubeSat. 17.7 to 20.2 GHz, approx. 40 × 60 cm aperture in three panels, peak gain in the order of 35.5 dB. Designed with QUPES, CHAMP 3D and ESTEAM, and validated by RF measurements.



Reflectarray antenna prototype designed with QUPES.



Quasi-periodic element layout optimised element by element in QUPES.

Technical highlights

SURFACE TYPES

- Printed reflectarrays
- Frequency selective surfaces (FSS)
- Transmitarrays
- Multi-panel and deployable surfaces
- Planar and curved surfaces

SYSTEM-LEVEL DESIGN

- Reflector systems with quasi-periodic surfaces
- Multi-band antenna systems
- Beam waveguides and quasi-optical networks
- Contoured and multi-beam coverage
- Four-colour spot beams with fewer apertures

ADVANCED APPLICATIONS

- CubeSats and SmallSats
- High-throughput satellites
- Synthetic aperture radar
- Ground stations
- Terrestrial 5G/6G

Integration with TICRA Tools

Combine QUPES with GRASP for reflector systems that include reflectarrays, FSS and quasi-optical components, CHAMP 3D for feed design, ESTEAM for platform scattering and installed performance, and UQ to quantify the effect of manufacturing tolerances.

The result is one consistent environment, from unit-cell definition and surface optimisation to full antenna-system analysis and validation.

Get in touch

Advance your quasi-periodic surface design capabilities.

Discover how QUPES takes reflectarray, FSS and transmitarray designs from unit cell to mission performance.

Request a demo or discuss your application with a TICRA engineer.

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