

ELECTROMAGNETIC SIMULATION FOR ELECTRONIC SYSTEM DESIGN IN AEROSPACE AND DEFENSE

The aerospace and defense industry relies heavily upon advanced electronic systems for field communications, control, targeting, threat detection, asset tracking, health monitoring, and theater operations. These advanced electronic systems often require multiple, high-fidelity antennas. Those antennas, in turn, require interference-free integration for maximum signal strength and reliability.



Overview

This technical document provides an overview of Altair's electromagnetics simulation strategies and technologies that support the development of complex electronic systems. These strategies and technologies address the needs and challenges of engineering managers, antenna and RF engineers, radar engineers, radio site engineers, and EMC engineers working at defense contractors, governmental defense organizations, and aerospace companies.

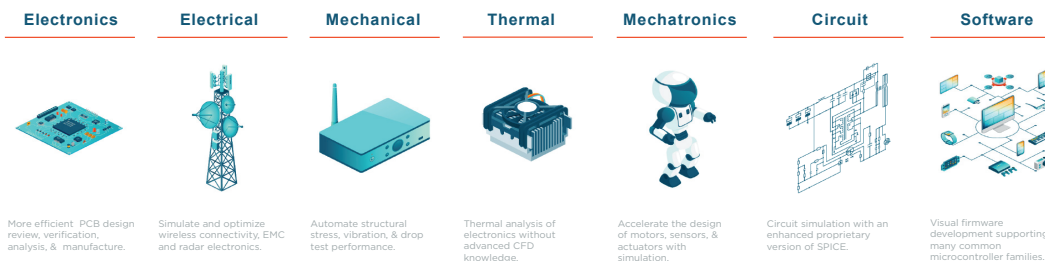
HARMONIZING ELECTRONIC SYSTEM DESIGN DISCIPLINES

Smart, connected products require a fundamental rethinking of design. As a result, product development is shifting toward true interdisciplinary systems engineering. In electronic systems, a vast variety of engineering disciplines must play in harmony.

Altair enables engineering teams to collaborate on all aspects of physical, logical, thermal, electrical, and mechanical design through a broad portfolio of solutions designed to integrate with and complement one another.

This interdisciplinary approach supports:

- Efficient PCB design review, verification, and analysis
- Simulation and optimization of wireless connectivity, EMC and radar systems
- Automation of structural stress testing, vibration testing and drop testing
- Efficient mechanical and thermal analysis
- Design of motors, electric drive systems, sensors and actuators for mechatronics and power electronics applications
- Circuit simulation using a proprietary version of SPICE
- Firmware development for many common microcontroller families



WIRELESS CONNECTIVITY, EMC AND RADAR

Altair's primary toolset for wireless connectivity, EMC and radar applications is Altair® Feko®.

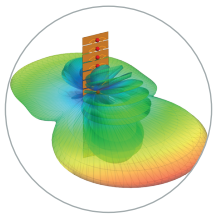
Feko addresses the broadest set of high-frequency electromagnetics applications, allowing teams to optimize wireless connectivity, including 5G, ensure electromagnetic compatibility (EMC), and perform radar cross section (RCS) and scattering analysis. It is used globally across multiple industries—including aerospace, defense, automotive, communications, and consumer electronics—to reduce development costs and time-to-market.

Main Applications with Altair Feko

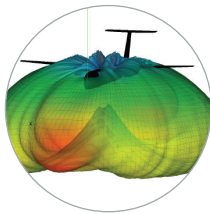
For wireless systems, EMC and radar applications, Altair Feko offers a comprehensive set of solutions, including:

- Antenna design and the analysis of installed antenna performance on large platforms
- Virtual test drives and virtual flight tests for platform connectivity
- Radar cross section and scattering analyses
- Electromagnetic compatibility
- Radio and Radar Coverage and Planning
- RF interference and spectrum management
- Analysis of radiation hazards and bio-electromagnetic scenarios
- Electromagnetic simulation and analysis of complex radomes
- RF and microwave devices
- Coupling with other Altair solver technologies to address multi-physics problems and use cases, including structural and thermal aspects.

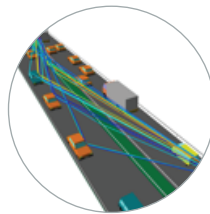
To learn more about how Feko helps engineers tackle each of these applications, visit altair.com/feko-applications/



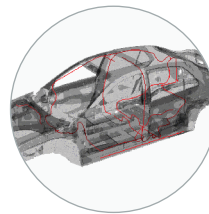
Antenna Design



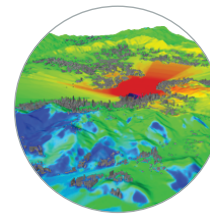
Antenna Placement & Coupling



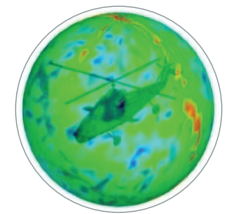
Virtual Drive & Flight Tests



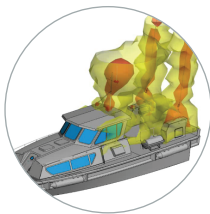
Electromagnetic Compatibility



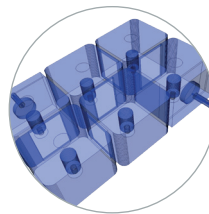
Radio & Radar Coverage & Planning



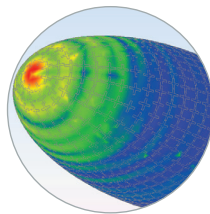
Scattering & RCS



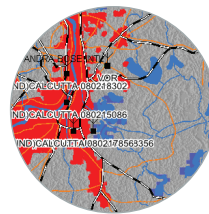
RADHAZ & Bio-Electromagnetics



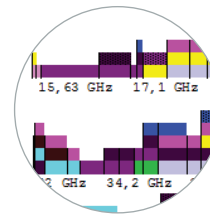
RF Devices



Radomes, Including FSS



Radio Frequency Interference

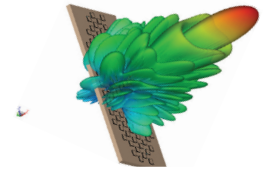


Spectrum Management

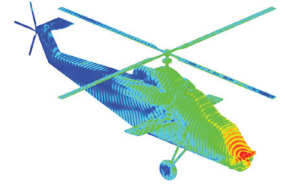
Antenna Design

Feko can be used to design a very wide range of antenna types, including:

- Wire antennas
- Microstrip patch arrays
- Horn antennas
- Reflectors
- Aperture antennas and lense
- Conformal antennas
- Phased arrays



Antenna Design



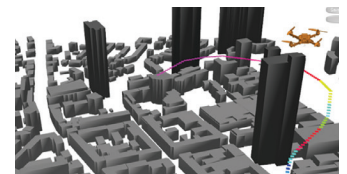
Antenna Placement and Coupling

Antenna Placement and Coupling

Installed antenna performance is heavily dependent on how and where antennas are integrated. Simulating an antenna mounted on an electrically large structure can be challenging. Feko's sophisticated solvers, powerful visualization features and intuitive user interface make it the leading tool for analyzing and optimizing antenna placement and coupling.

Airbus Helicopters relies on Feko to help them quickly design and verify antenna placement to ensure optimum performance, regardless of the platform configuration. To hear Hervé Dutruc, head of antenna installation at Airbus Helicopters, share their story, click here:

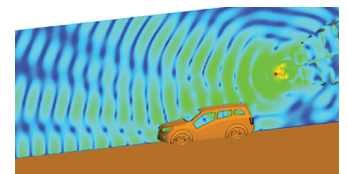
altair.com/resource/airbus-helicopters-relies-on-simulation-to-develop-antennas-quickly-and-efficiently



Virtual Flight and Drive Tests

Virtual Flight and Drive Tests

Virtual flight tests and test drives are essential for reducing flight and road test costs and schedules while ensuring and improving system robustness. Feko uses Altair® WinProp™ technology to provide real-world simulation necessary for performance assessments of communication and [ADAS radar systems](#), where classical antenna parameters are insufficient.



Electromagnetic Compatibility

Scattering and RCS

The scattering performance of an object describes how energy is scattered when an object is exposed to incident fields. Feko helps customers analyze scattering performance for a wide range of electrical sizes and geometries to answer radar cross-section (RCS) questions for applications in the aerospace and defense, automotive, energy, and communications industries.

Electromagnetic Compatibility

EMC/EMI immunity and emissions analysis involving cables, antennas and other devices can be a challenging exercise. Feko is a strong solution for such applications, as it can simulate shielding effectiveness, electromagnetic pulses, lightning effects, HIRF, reverberation and anechoic chambers.

Radio Frequency Interference

From interference between multiple transmitters and receivers in a site, to broadcasting stations and aeronautical equipment, to wireless networks, Feko includes Altair WRAP technologies to enable customers to anticipate, analyze and mitigate RF interference effects including intermodulation, harmonics, antenna coupling, transmitter spectrum, receiver selectivity and blocking.

Radiation Hazard and Bio-Electromagnetics

For many applications, electromagnetic fields hazards must be constrained within standardized limits. Feko automates the simulation and visualization of radiation hazard levels including the calculation of specific absorption rate (SAR) values and human safety guidelines from ICNIRP.



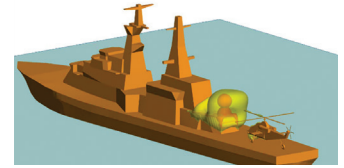
The tools is very easy to use. Feko is natural. You don't need a guideline to use it."

Hervé Dutruc, Head of Antenna Installation, Airbus Helicopters

Radio and Radar Coverage and Planning

Analysis of radio and radar coverage for wireless network planning and large platform radar applications must take into account a wider range of factors which make their simulation very complex.

Feko includes WinProp and WRAP technologies for wireless propagation simulation and spectrum management to provide simulation and analysis of wireless coverage and to enable radio network planning across indoor, urban, and rural environments—from single buildings to nationwide.

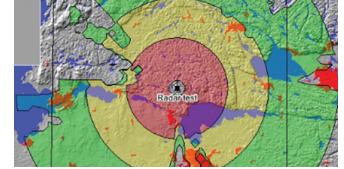


Radio and Radar Coverage and Planning

Spectrum Management

Maximum utilization of valuable radio spectrum assets requires careful planning, management and distribution.

WRAP along with Feko's tools for technical analysis of coverage, interference and optimization of spectrum utilization ensure that spectrum regulators can efficiently manage the ever-increasing demands of the full range of wireless systems.

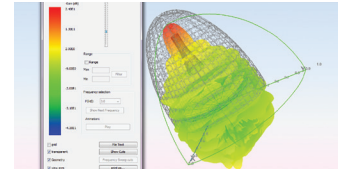


Spectrum Management

Radome Simulation and Analysis

Radomes on aircraft serve to protect antennas and contribute to aerodynamic efficiency. They must also deliver the required electromagnetic transparency.

Feko, with Altair's NewFASANT technology, provides the fastest solution for analyzing radomes. Feko has been designed to accommodate electrically large and frequency-selective surfaces.

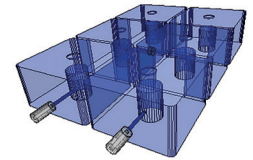


Radome Simulation and Analysis

RF Devices

The design and manufacture of RF components for today's market requires rapid design capability together with fast execution speed in order to shorten the development cycle.

The [Altair Partner Alliance](#) (APA) provides access to [uWave Wizard](#). It enables rapid microwave circuit design, including filters, resonators, couplers and passive components, thanks to built-in optimizers interacting with hundreds of parameterized RF library elements and user defined structures.



RF Devices

FOR MORE INFORMATION

For more information on all of Altair's electromagnetic simulation solutions mentioned in this document, be sure to check out our aerospace and defense webinar series:

web.altair.com/esd-webinar-series-aerodefense.

OUR FULL SOLUTION SPECTRUM UNDER ONE LICENSE

True interdisciplinary systems engineering requires the ability to leverage a wide range of cutting-edge engineering tools in a collaborative setting. Altair accommodates this by providing access to all our tools, including all the technologies highlighted in this document, under one license through Altair Units.

Altair Units is our new, unified licensing system that gives access to every Altair product and the power to solve on any scale. This new model delivers enhanced inclusivity at various price points and will allow customers to maximize their software dollars through the flexibility to run software anywhere, freedom to choose from a variety of software tools with unparalleled value from our unique business model.

DISCOVER HOW ALTAIR CAN REVOLUTIONIZE YOUR APPROACH TO INNOVATION

Altair pioneered a patented, units-based, subscription licensing model for software which has transformed the way our customers streamline product innovation and get to market faster. Customers have full access to all our software instantly, including more than 150 partner products, and can run these applications on-demand locally or in the cloud. Packaged as a comprehensive set of applications, our units-based structure is scalable, shareable, and more cost effective than obtaining individual licenses.

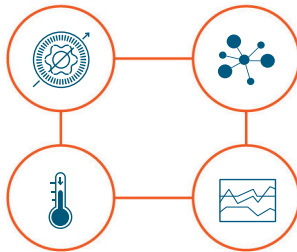


POOL OF UNITS

Users draw units from the pool to access multiple products, across any location.

CHOICE OF APPLICATION

Maximizing software dollars through the freedom to choose.



FREEDOM TO USE HOWEVER NEEDED

Best of all, you can maintain your license and run your computation anywhere your teams and compute infrastructure are located, on your local machines or on your own local HPC, in the cloud or in-hybrid environment.



Altair is a global leader in computational science and artificial intelligence (AI) that provides software and cloud solutions in simulation, high-performance computing (HPC), data analytics, and AI. Altair enables organizations across all industries to compete more effectively and drives smarter decisions in an increasingly connected world – all while creating a greener, more sustainable future.



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