FEKO Comprehensive Electromagnetic Solutions

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About this issue

In this second edition of 2011, a review is given of the papers that were submitted to the FEKO session at the recently held ACES conference. We will take a look at some of the features to be released with FEKO Suite 6.1 and see what is new in Antenna Magus 3.0 (released on the 20th of April). A reminder of the FEKO student competition is included for all our academic users.

If you would like to comment or ask questions about the content of this issue, please send us an email, or contact your local distributor.

quarterly@emss.co.za

FEKO at ACES 2011

The 27th Annual Review of Progress in Applied Computational Electromagnetics (ACES) was held in Williamsburg, Virginia, USA at the end of March 2011. On the 1st of April an international FEKO users meeting took place, where users shared valued feedback with the FEKO team.

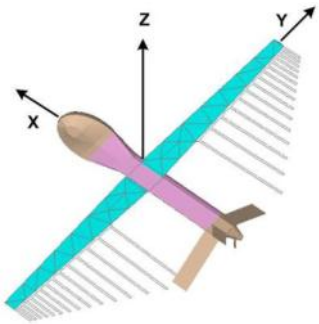
One of the sessions at the conference focused on electromagnetic simulation using FEKO. A review of this session is given here, with a recap of a selection of presented papers.

- **VHF Antennas on Unmanned Air Vehicles (UAV) for a Simplified Synthetic Aperture Radar (SAR)**, Taeyoung Yang and William A. Davis, The Bradley Department of Electrical & Computer Engineering, Virginia Polytechnic Institute and State University, VA, USA

A log-periodic antenna design is presented for a UAV. Conventional SAR and a new simplified approach using a-priori phase information of the synthesized array are implemented to evaluate the performance of the designed antenna. A scenario for locating a wire target is demonstrated using both the conventional and the new simplified SAR through simulations.

The sampling distance along the flight path is assumed to be quarter wavelength to meet the required minimum sampling distance of the Nyquist criteria. At each sampling point, the scenario was simulated by using FEKO.

The simulated results show that the new simplified SAR is both simple and accurate for locating a target as long as the phase of the SAR signal can be successfully unwrapped, offering a viable alternative to conventional SAR processing.



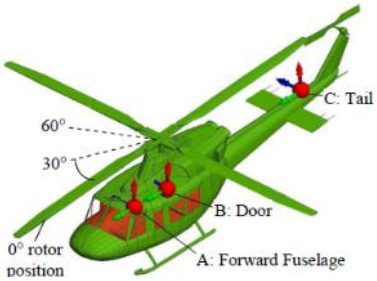
Folded log-periodic antennas on UAV.

> "The original model, which was based on a rudimentary AutoCAD model, consisted of thousands of geometrical parts that were sorted, modified and simplified using CADFEKO."

- **The Computational Electromagnetic Modelling of the CH-146 Griffon Helicopter Using FEKO,** Sarah A. Rogers and Joey R. Bray — Department of Electrical and Computer Engineering, Royal Military College of Canada, Kingston, Canada

A CEM model of the CH-146 Griffon helicopter was created by the authors to characterize the helicopter's electromagnetic environment when excited by a new satcom antenna. The original model, which was based on a rudimentary AutoCAD model, consisted of thousands of geometrical parts that were sorted, modified and simplified using CADFEKO.

The CEM model was used to determine the best of three proposed locations for the installation of the satcom antenna on the helicopter. The Multi-Level Fast Multipole Method (MLFMM) in FEKO was used to determine the best antenna location based on the radiation patterns and rotor modulation. The near-field and surface current levels were simulated to determine which of the existing antennas were at risk of experiencing conducted and radiated interference.



Model of a CH-146 Griffon helicopter.

- **Wire Realization of a Tapered Slot Antenna with Reconfigurable Elements**, William O'Keefe Coburn (1) and Amir I. Zaghloul (1,2) — (1) U.S. Army Research Laboratory, Adelphi, MD, USA, (2) Virginia

FEKO at ACES 2011

Polytechnic Institute and State University, VA, USA

"... [the authors] construct a variation of the [Vivaldi] antenna using closely spaced thin wires."

The authors consider a generic Vivaldi exponentially tapered slot that is a single layer planar structure. Using the shape of the metallic arms, they construct a variation of the antenna using closely spaced thin wires. This paper summarises the modelling investigation using FEKO and the presented results are encouraging for further optimisation of the design and prototype fabrication on thin film substrates.

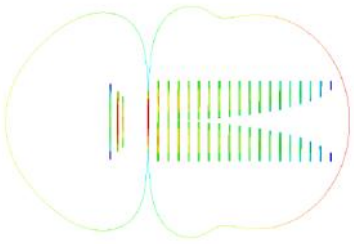


*Image from **Wire Realization of a Tapered Slot Antenna with Reconfigurable Elements** by William O'Keefe Coburn and Amir I. Zaghloul.*

Other papers presented at the FEKO session at ACES 2011:

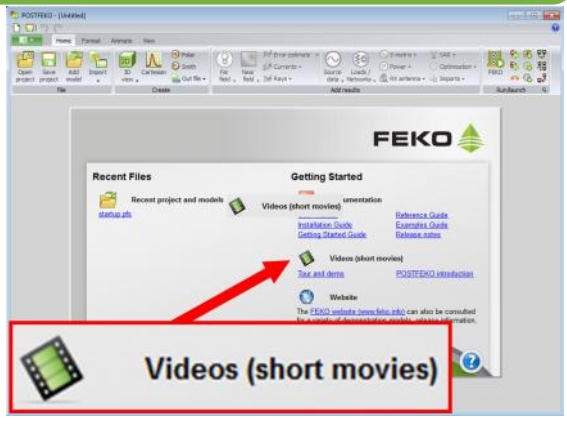
- **Adaptive Design Specifications and Coarsely-Discretized EM Models for Rapid Optimization of Microwave Structures with FEKO,** Slawomir Koziel — Engineering Optimization & Modeling Center, School of Science and Engineering, Reykjavik University, Iceland
- **On the Dispersive Properties of Planar Spiral Antennas,** Mohamed A. Elmansouri and Dejan S. Filipovic — Department of Electrical, Computer, and Energy Engineering, University of Colorado, Boulder, USA
- **Simulation of a GPS Antenna Located at the Roof of an Automobile,** M. Tecpoyotl-Torres, J. G. Vera-Dimas, J. A. Damián-Morales and J. J. Escobedo-Alatorre — Center for Research of Engineering and Applied Sciences (CIICAp), University of Morelos State (UAEM), Mexico
- **Computational Electromagnetic Modeling of SansEC™ Sensors**, Laura J. Smith (1), Kenneth L. Dudley (2), and George N. Szatkowski (2) — (1) Safety Critical Avionics Systems Branch, NASA Langley Research Center, Hampton, VA, USA, (2) Electromagnetics and Sensors Branch, NASA Langley Research Center, Hampton, VA, USA
- **Selection of New Features in the Electromagnetic Solution Kernel of FEKO Suite 6.0**, Ulrich Jakobus, Marlize Schoeman, Johann van Tonder, Danie Ludick, and Willem Burger — EM Software & Systems – S.A. (Pty) Ltd, Stellenbosch, South Africa
- **Electromagnetic Launch Vehicle Fairing and Acoustic Blanket Model of Received Power using FEKO**, Dawn H. Trout (1,2), James E. Stanley (3), and Parveen F. Wahid (1) — (1) School of Electrical Engineering and Computer Sciences University of Central Florida, FL, USA, (2) Kennedy Space Center KSC, FL USA (3) Department of Electrical and Computer Engineering, Florida Institute of Technology, FL, USA
- **Development of a Deployable UHF Crossed Dipole Antenna Suitable for Nano Satellites**, Wendy Lippincott— Naval Research Laboratory, Washington DC, USA
- **The Use of FEKO in Providing High Fidelity Radar Simulation**, Erin L. Kashiwada and Eric P. Lam — Battlefield Radar Department, Thales-Raytheon Systems, Fullerton, CA, USA
- **CADFEKO Curve Primitive Geometry Functions to Create a Reduced-Drag, Low-Profile Wideband Antenna**, Christian W. Hearn — Applied EM, Inc. and Virginia Tech Antenna Group, USA
- **RCS Enhancement of Concealed/Hidden Objects at Terahertz (THz),** Yoginder Kumar Negi, Venkat Prasad Padhy and N. Balakrishnan, Supercomputer Education and Research Center, Indian Institute of Science, Bangalore, INDIA
- **Using FEKO for Electromagnetic Analysis of Carbon-Fiber Composite Structures**, Mohammadali Ansarizadeh, Alper Ozturk and Robert Paknys — Department of Electrical and Computer Engineering, Concordia University, Montreal, Canada

Become proficient in POSTFEKO — within 15 minutes!

"The POSTFEKO introduction video ... can be accessed from the POSTFEKO start page which is displayed when a new instance of POSTFEKO is opened."

In FEKO Suite 6.0 the POSTFEKO interface has been completely redesigned. The many post-processing features are organised using a ribbon style layout. Users who are unfamiliar with the new interface can quickly learn how to use it by watching the POSTFEKO introduction video. A link to this video can be accessed from the POSTFEKO start page which is displayed when a new instance of POSTFEKO is opened.

The video starts by giving an overview of the different ribbon tabs and how they are used to group together the options available for visualisation of results in POSTFEKO. The video also contains a demonstration where some typical requests are set up in CADFEKO, the results of which are then displayed in POSTFEKO using 3D views and different graph types.



The POSTFEKO start page with links to the POSTFEKO introduction video and other Getting Started information.

FEKO Student Competition 2011

Students are invited to submit a presentation showcasing the innovative ways in which they use FEKO (by the closing date of 30 September 2011) and stand a chance to win the following prizes for themselves and their supervisors:

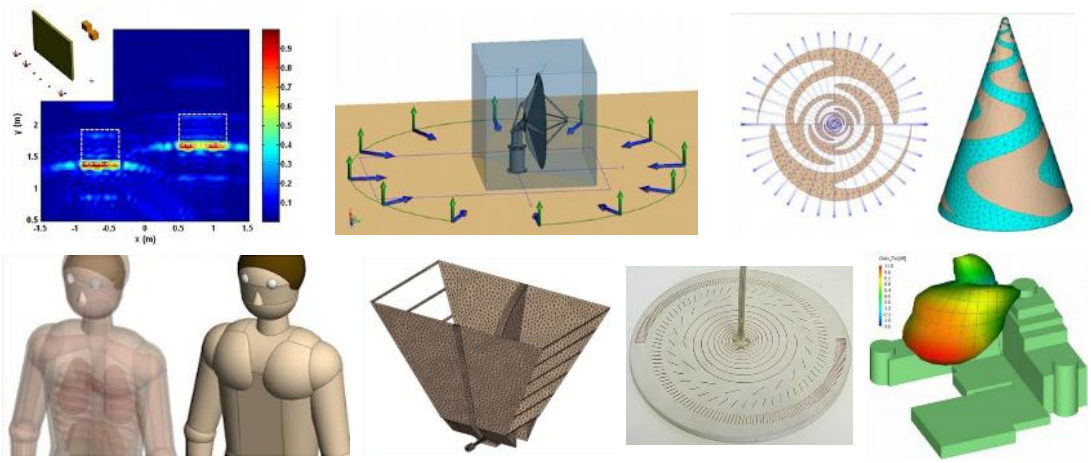
Student prize: A laptop computer or a trip to an international EM engineering conference up to the value of **US$2000.**

Supervisor prize: An online store gift voucher to the value of **US$400**.

Previous entries have included interesting antennas designed using FEKO, computational methods tested against FEKO's implemented methods, radiation hazard, lighting protection and antenna placement studies conducted in FEKO and the intricate modelling of various structures in FEKO.

The competition is open to all under-graduate and post-graduate students working on projects in EM engineering and making use of FEKO. The online entry form and further information is available on the FEKO website (http://www.feko.info/about-us/student-competition).

"Students are invited to submit a presentation showcasing the innovative ways in which they use FEKO"

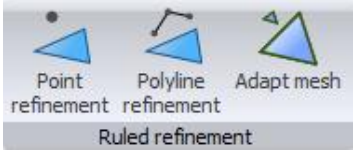


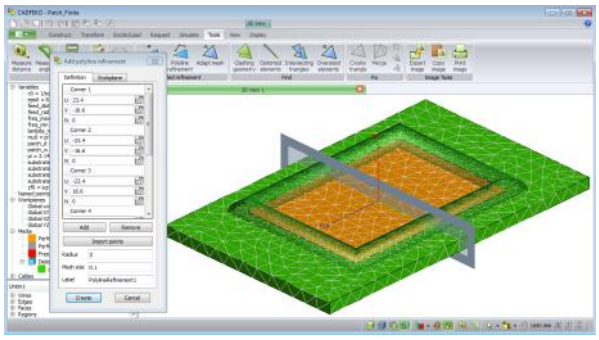
Models and images from some of the entries received during the past five instalments of the competition.

FEKO Suite 6.1 feature highlights

With FEKO Suite 6.1 to be released soon, we asked our developers what features users can look forward to. New features include:

- **Redesigned CADFEKO graphical user interface (GUI).** The CADFEKO front-end will boast a new look to match the ribbon style layout of POSTFEKO.
- **Automatic report generation from POSTFEKO.** Users will soon be able to use POSTFEKO's report generation to automatically generate Microsoft Word and Powerpoint documents as well as PDFs of their 3D views, graphs and other results.
- **Numerical Green's Function**. With this feature, a fixed structure can be modelled and the self-interaction part of the solution saved, avoiding unnecessary repetition of the same calculations in further simulations involving the structure. For example, when performing an antenna placement study on a helicopter, the helicopter platform can be defined as static geometry in the first simulation run, saving on resources in subsequent simulations where the antenna is placed in different locations on the same platform.
- **Cable modelling available in CADFEKO**, including the MoM/MTL for cable problems far from ground. Users will be able to set up cable problems from within the CADFEKO user interface.
- **Local mesh refinement rules and adaptive mesh refinement**. CADFEKO's mesh handling has been improved with the addition of a number of features, including the ability to define mesh refinement rules.





CADFEKO 6.1 will have a redesigned GUI and new mesh features such as local mesh refinement rules.

"FEKO Suite 6.1 features include … automatic report generation from POSTFEKO, local mesh refinement rules and adaptive mesh refinement."

Add your own designs in Antenna Magus 3.0

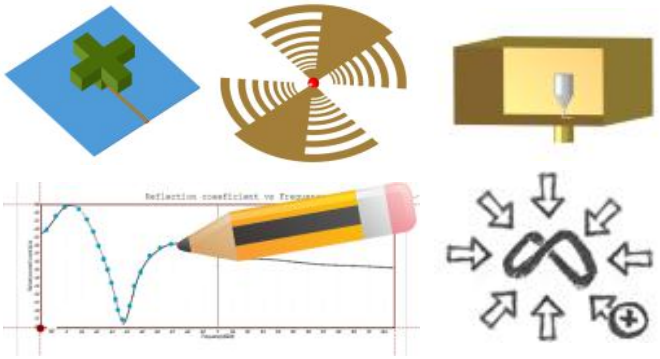
Antenna Magus version 3.0 was released on 20 April 2011. Utilities and libraries have been added to the Antenna Magus toolbox to help simplify everyday antenna design tasks. One of the exciting new features is its antenna knowledge management capability.

The Antenna Magus database now contains 148 antennas and seven transitions which can be designed for various values of a variety of design goals. Validated simulation models of these user-designed antennas and transitions can be exported to FEKO. The new Chart Tracing tool enables users to extract data points from graph images. Also new in version 3.0 are the substrate and waveguide libraries.

"Antenna Magus 3.0 provides engineers with a content management system which allows them to store antenna information … in a logical and accessible way."

Antenna Knowledge Management

Antenna Magus 3.0 provides engineers with a content management system which allows them to store antenna information in the form of documents, sketches, design algorithms, measured data and models in a logical and accessible way. The framework is consistent amongst all antennas in the Antenna Magus database, making it easy to find information and compare different antennas. As more knowledge of a specific antenna is gained, or as specifications and requirements change, the information can be extended and improved. Once information has been captured, it can be shared securely amongst colleagues.



Antenna Magus 3.0 boasts new antennas (like these crossed T dielectric resonator and two-arm planar log-periodic antennas) and transitions (such as this wideband coaxial to waveguide transition) added to its database and new utilities including the Chart Tracing tool and the antenna knowledge management system.

Exhibitions in 2011

FEKO will be exhibited at many conferences this quarter, including those listed below. For a complete list of events and for more information, visit www.feko.info/about-us/events.

5 - 10 June	IEEE (MTT-S) International Microwave Symposium, Baltimore, Maryland, USA
3 - 8 July	IEEE (AP-S) International Symposium on Antennas and Propagation and USNC/URSI National Radio Science Meeting, Spokane, Washington, USA
14 - 19 Aug	IEEE (EMC-S) International Symposium on Electromagnetic Compatibility, Long Beach, CA, USA
12 - 15 Sept	8th Military Antennas Summit, Washington, DC, USA
20 - 21 Sept	Antenna Systems Symposium, Nashville, TN, USA

About FEKO

Applications

- Antenna Design
- Antenna Placement
- EMC Analysis
- Scattering Analysis
- Biomedical
- Microstrip circuits
- Waveguide
- Cable Analysis

Fast Solutions

- Parallel Processing (Multi-Core CPUs, Clusters)
- GPU Computing
- Fast Frequency Sweep
- Out-of-Core Solving

Solution Techniques

- Method of Moments (MoM)
- Multi-level Fast Multipole Method (MLFMM)
- Finite Element Method (FEM)
- Physical Optics (PO)
- Ray-Launching Geometrical Optics (GO)
- Uniform Theory of Diffraction (UTD)
- Planar and Periodic Green Functions
- True Hybridisation of MoM/FEM, MoM/PO, MoM/GO and MoM/UTD
- MoM for Multiple, Complex Dielectric Bodies

Model Formats

- Solid Models (Parasolid, DXF, ACIS, CATIA, Pro-E, IGES, STEP, Unigraphics)
- Meshes (CADFEKO, FEMAP, NASTRAN, AutoCAD DXF, STL, PATRAN, ANSYS CDB, ABAQUS, ASCII data format, GID)

Services

- Extended Service Contract
- On-site Training (Short Course)
- CAD Preparation
- Runtime Solutions
- Engineering Consulting Services

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