
https://ieeexplore.ieee.org/document/9392848
A “career” is an individual’s metaphorical “journey” through learning, work, and other aspects of life.

Job is different from Career

Career Path for Antenna Engineers in Industry

**Research → Industry Job → Managerial Position**

- Master’s/PhD
- Post Doctoral Positions
- Application Engineer
- Design Engineer
- ......
- Group Leader
- Technical Manager
- ......

- Progress in career is based on opportunities presented along the way.
- Success or failure can then depend on how well these opportunities, no matter small or big, are taken advantage of.

My Career Path

Ph.D. 1985-87
Scientific Officer 1987-91
NSERC Fellow 1991-92
NRC Associate 1993-95
Research Professor 1995-1999

President 2000-2017

President 2002-2014

Vice President – Business Development 2014-Present
Golden Rules of PhD

1) A NEW problem with a NEW solution
2) An OLD problem with a NEW solution
3) A NEW problem with an OLD solution
4) OLD problem with an OLD solution

Publish….Publish….Publish….
Ph.D - Studies on Characteristics of Single and Coupled Cylindrical Striplines

Flexible Electronics ??
Ph.D - Studies on Characteristics of Single and Coupled Cylindrical Striplines
Ph.D - Studies on Characteristics of Single and Coupled Cylindrical Striplines

STUDIES ON CHARACTERISTICS OF SINGLE AND COUPLED CYLINDRICAL STRIPLINES

THESIS SUBMITTED TO THE INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENGINEERING

BY

C. JAGADESWARA REDDY

Centro for Research and Training in Radar and Communication INDIAN INSTITUTE OF TECHNOLOGY Kharagpur, 721 302 India JUNE, 1987
FMCW Radar

Pulse Radar

Slotted Array for Surface Detection Radar

https://en.wikipedia.org/wiki/Slot_antenna
NRC Resident Associate – NASA Langley Research Center

Professor Constantine Balanis

https://sites.nationalacademies.org/PGA/RAP/index.htm
NRC Resident Associate – NASA Langley Research Center

Develop Hybrid FEM/MoM for Cavity Backed Aperture Antennas

You don't know what you can do until you try.

~ Publilius Syrus
Asymptotic Waveform Evaluation (AWE) / Model Based Parameter Estimation (MBPE) / Reduced Order Model (ROM) – Method of Moments (MoM)

\[ Z(k) = \frac{j k \mu_0}{2 \pi} \int \int \mathbf{T} \cdot \mathbf{J} \exp(-j k R) \frac{d s'}{d s} \]

\[ V(k) = \int \int \mathbf{T} \cdot \mathbf{E}_{\text{inc}} \, d \mathbf{s} \]

\[ I(k) = \sum_{n=0}^{\infty} m(n) (k - k_o)^n \]

\[ m(n) = Z^{-1}(k_o) \left[ \frac{V(n)(k_o)}{n!} - \sum_{q=0}^{n} \frac{(1 - \delta_{q0}) Z(q)(k_o)m_{n-q}}{q!} \right] \]

\[ \sum_{n=0}^{L+M+1} m(n) (k - k_o)^n = \frac{P_L(k - k_o)}{Q_M(k - k_o)} \]

Fig. 1. RCS frequency response of the square plate (1 cm × 1 cm × 1 cm) from 20 to 40 GHz.

Fig. 2. RCS frequency response of the cube (1 cm × 1 cm × 1 cm) from 2 to 22 GHz.

Asymptotic Waveform Evaluation (AWE)/ Model Based Parameter Estimation (MBPE)/ Reduced Order Model (ROM) – FEM/MoM Hybrid Method

\[ e(k) = \frac{P_L(k)}{Q_M(k)} \]

\[ P_L(k) = a_0 + a_1 k + a_2 k^2 + a_3 k^3 + \ldots + a_L k^L \]

\[ Q_M(k) = b_0 + b_1 k + b_2 k^2 + b_3 k^3 + \ldots + b_M k^M \]

Hampton University – Teaching

Electrical Engineering Program

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>EGR 101</td>
<td>Intro. to Engineering</td>
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<tr>
<td>EGR 102</td>
<td>Intro. Structured Programming</td>
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<td>EGR 218</td>
<td>Circuit Analysis I</td>
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<td>EGR 220</td>
<td>Circuit Analysis Lab I</td>
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<td>Circuit Analysis II</td>
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<td>ELN 306</td>
<td>Electromagnetic Waves</td>
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<tr>
<td>ELN 313</td>
<td>Electromagnetic Waves Lab</td>
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Dr. Demetris Geddis
Assistant Dean and Department Chair of Electrical and Computer Engineering
Chair – IEEE Hampton Roads Section

School of Engineering and Technology
Hampton University
Phone: 757-727-5299
E-mail: demetris.geddis@hamptonu.edu
You never know what you can do until you try, and very few try unless they have to.

— C. S. Lewis —
Innovative Antenna Solutions

- Member of Hampton Roads Technology Incubator (2000-2006)
- Graduated from HRTI in 2006
- Member of Technology Hampton Roads (THR, formerly HRTC)

Training in:

- Business Plans
- Accounting (Job costing)
- Contract Negotiations
- Intellectual Property
- Human Resources
- Networking
# SBIR / STTR Projects

<table>
<thead>
<tr>
<th>Agency</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase II.5</th>
<th>Success Rate</th>
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<td>ARMY</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>57%</td>
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<tr>
<td>NAVY</td>
<td>17</td>
<td>12</td>
<td>1</td>
<td>71%</td>
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<td>Air Force</td>
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<tr>
<td>NASA</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
<td><strong>21</strong></td>
<td><strong>4</strong></td>
<td><strong>66%</strong></td>
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## Collaborations

- The Ohio State University
- Virginia Tech
- University of Colorado
- University of Delaware
- Unitech
- Eagle Aviation Technologies
- Harris Corporation
- L3 Communications
- Argon ST
- DRS Technologies
- ATK
Innovative Antenna Solutions

A few unique technologies developed at Applied EM

**Compact Broadband Direct Finding Array**

**Conformal “paint-on” Antenna Technology**

**UTD for faceted Geometries**
Applied EM closed its doors Dec 2017 after successful run 2000-2017
Feko is an abbreviation derived from the German phrase "Feldberechnung bei Körpren mit beliebiger Oberfläche" (field computations involving bodies of arbitrary shape).
It’s about...
INNOVATION....
transformed
into technologies
that
CHANGE LIVES

It’s about
CREATING SUPERIOR
products for the
ELECTRONICS INDUSTRY

It’s about...
SIMULATING REALITY
and
UNDERSTANDING COMPLEXITY

Distribution in North America

- Sales
- Marketing
- Technical Support
- Training

Tradeshows/Conferences
- ACES
- IEEE APS
- IEEE MTT (IMS)
- IEEE EMC
- AMTA
Successful acquisition of EMSS (USA) by Altair
June 1, 2014

Altair to Acquire EM Software & Systems – S.A. (EMSS)

Adds Comprehensive Electromagnetic Solver Capabilities to HyperWorks® Simulation Suite

TROY, Michigan, Dec. 10, 2013 – An agreement-in-principle has been reached between Altair and EMSS, pursuant to which Altair will acquire 100 percent of EM Software & Systems – S.A. (Pty) Ltd and its international distributor offices in the United States, Germany, and China. The agreement is expected to close early in 2014.
Altair – VP of Business Development – Electromagnetics (Americas)

About Altair

$459M
FY19 Revenue

3,000+
Engineers, Scientists, and Creative Thinkers

1985
Founded and Headquartered in Troy, MI U.S.

11,000+
Customers Globally

86
Offices in 25 Countries

150+
Altair and Partner Software Products
11,000+ Customers Worldwide

<table>
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<tr>
<th>Automotive</th>
<th>Aerospace</th>
<th>Civil Engineering</th>
<th>Education</th>
<th>Energy</th>
<th>Financial Services</th>
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<td>Ford</td>
<td>Boeing</td>
<td>ARUP</td>
<td>Columbia University</td>
<td>Mitsubishi</td>
<td>TD Bank Financial Group</td>
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<td>GM</td>
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<td>LIXIL</td>
<td>Imperial College London</td>
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<td>Hyundai</td>
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<td>TUM</td>
<td>Chiyoda</td>
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<td>KAI</td>
<td>SOM</td>
<td>Nelson Mandela University</td>
<td>ConocoPhillips</td>
<td>pwc</td>
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<td>Lockheed Martin</td>
<td>Thornton Tomaselli</td>
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<td>Reliance Industries</td>
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<td>University of Virginia</td>
<td>Siemens</td>
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<th>Heavy Rail</th>
<th>Industrial Goods</th>
<th>Life &amp; Earth Sciences</th>
<th>Material Suppliers</th>
<th>Technology</th>
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<td>Alstom</td>
<td>Schneider Electric</td>
<td>SK Innovation</td>
<td>Quartus</td>
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<td>SK Innovation</td>
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<td>Atlas Copco</td>
<td>SK Innovation</td>
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<td>SK Innovation</td>
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<td>Kobelco</td>
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Data Analytics and AI

With the help of AI and machine learning, Altair turns difficult data into smart data, leading to actionable insights that help you solve your toughest challenges.

Simulation

Use Altair’s simulation technology to improve development efficiency, optimize product performance, and accelerate growth.

High-performance Computing

Whether onsite or in the cloud, Altair’s HPC solution accelerates your engineering and design workload especially compute-intensive tasks like solvers, optimization, modeling, visualization, and analytics.
Altair – VP of Business Development – Electromagnetics (Americas)

SIMULATION
Altair High Frequency Electromagnetic Simulation Solutions

Altair Feko - High Frequency EM Simulations

Altair WinProp - Wave Propagation & Radio Network Planning

WRAP – Spectrum Management and Co-site Analysis

PollEx – PCB Analysis Tool

- Signal Integrity
- Power Integrity
- Thermal Analysis
- DFE
- DFE+
- DFA
- DFM
CMA – Characteristic Mode Analysis

• CMA gives you fundamental physical insights that a driven simulation doesn’t give you.
• CMA can help in antenna design: how to modify the shape, where to place excitations and loads.

“Putting Physics Back into Simulations”

Machine Learning for Antenna Design and Optimization

Antenna Design and Optimization Using Machine Learning

On-Demand Short Course

Machine learning is a method of data analysis that automates analytical model building. As the complexity of antennas increases each day, antenna designers can take advantage of machine learning to generate trained models for their physical antenna designs and perform fast and intelligent optimization on these trained models. Using the trained models, different optimization algorithms and goals can be run quickly, in seconds that can be utilized for companion studies, stochastic analysis for tolerance studies etc.

This short course presents the process of fast and intelligent optimization by adopting the Design of Experiments (DOE) and Machine Learning using Altair FEKO. We discuss specific examples that showcase the advantages of using ML for antenna design and optimization.

Access Short Course

Speakers

Dr. C.J. Reddy
Vice President, Business Development - Electromagnetics

Dr. Reddy was awarded the US National Research Council (NRC) Senior Research Associateship at NASA Langley Research Center. He is currently a Fellow of IEEE, ARES and AMTA and has published 37 journal papers, 17 conference papers and 18 NASA Technical Reports to date.

Gopikrish Gopalakrishnan
Technical Regional Manager

Gopi graduated from University of Massachusetts with a Master’s degree in Computational Engineering in 2007 and working in the field of CAD since then. He is a member of IEEE and published actively on topics like High Impedance Surfaces, Line of Sight antennas, LTE, Radar, Characteristic Mode Analysis, SI and Machine Learning.

Successful 5G Innovations

Ubiquity of network coverage with a minimum of base stations

Realize Campus Networks for new Industrial Applications

Accelerate development of Car2X communication

Make the pace for 5G Antennas and IIOT Infrastructure
Virtual-Drive Tests for ADAS Sensors

Radar for ACC – Bridge Scenario

- Computation of field strength, delay and Doppler shift for each ray
- Analysis of received ACC signal for detection of objects
- Evaluation of results for duration of 3.0 seconds
- Comparison of 3D rays and Doppler channel profiles over time
Cable Harness Electromagnetic Compatibility

Cable Harness in Automotive Environment

Cross talk between differential pairs in the same bundle. Blue: NEXT. Green: FEXT.

Near end crosstalk (NEXT)

Far end crosstalk (FEXT)

Differential cross talk between bundles. Blue: NEXT. Green: FEXT
Aircraft Radome for Weather Radar

- Nosecone of an aircraft is a radome protecting the weather radar antenna (typically a slotted waveguide antenna array)
**Multiphysics**

**Aircraft Nosecone Radome**
- Feko – Electromagnetics
- AcuSolve – Wind Loading
- OptiStruct – Structural Analysis
- Radioss – Bird Strike
- HyperStudy – Optimization using Machine Learning

**Radar System Design**
- Activate – 1D System Modeling
- AcuSolve – Wind Loading
- OptiStruct – Structural Analysis
- Flux – Motor Design
- Feko – Reflector Antenna Analysis
Implant Safety with Magnetic Resonance Imaging (MRI)

Temperature after 600s

Absorbed EM field

Hip Implant
Implant Antenna Design and Safety

Pacemaker

Low profile, high gain PIFA design for ISM band (400 MHz)

Surface Currents

Total gain

<table>
<thead>
<tr>
<th>Standard</th>
<th>Basic Restriction [W/kg]</th>
<th>SAR Results Renewal RF [W/kg]</th>
<th>Factor of Standard (%)</th>
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<tbody>
<tr>
<td>IEEE (North America)</td>
<td>2W/kg 1g cube</td>
<td>0.026</td>
<td>1.3%</td>
</tr>
<tr>
<td>ICNIRP (Europe)</td>
<td>2W/kg 10g cube</td>
<td>0.00734</td>
<td>0.367%</td>
</tr>
</tbody>
</table>
VOLUNTEERING
Volunteer Activities

• **Reviewer**
  - IEEE AP-S/MTT Transactions / Magazine
  - ACES Journal / Conference
  - AMTA Conference
  - EuCAP
  - SAE World Congress

• **Associate Editor – IEEE Open Journal on Antennas and Propagation**

• **Board Member**
  - ACES
  - AMTA

• **Chair - IEEE AP-S YP Committee**

• **IEEE Fellows Committee**

• **Conferences - Host/Cohost**
  - ACES 2011
  - IEEE APS/URSI 2014
  - ACES 2015
  - AMTA 2018

• **And more….**
PHILANTHROPY
Philanthropy - Giving back to the Society

• IEEE
  ➢ Student Member
  ➢ Member
  ➢ Senior Member
  ➢ Fellow

• IEEE Antennas and Propagation Society
  ➢ Attending the Symposium from 1992..

https://ieeetv.ieee.org/ieeetv-specials/heritage-circle-reddy

https://www.ieeefoundation.org/
IEEE AP-S C.J. Reddy Travel Grant for Graduate Students

https://2021apsursi.org/CJRTG.asp

Submit Papers to 2021 IEEE Antennas and Propagation Symposium to qualify!!

Paper Submission Deadline: May 15, 2021

Enquiries on C. J. Reddy Travel Grant for Graduate Students should be directed to:

Eng Leong Tan
Nanyang Technological University, Singapore 639798
E-mail: eeltan@ntu.edu.sg
MENTORS
Gratitude for Mentors

• Dr. M.D. Deshpande, my Ph.D. advisor at IIT Kharagpur, now at the NASA Goddard Space Flight Center;

• Dr. B. K. Sarkar of SAMEER;

• Michel Cuhaci of the CRC;

• Tom Campbell at the NASA Langley Research Center;

• Prof. John Volakis at Florida International University;

• Prof. Prabhakar Pathak at The Ohio State University;

• Dr. Ulrich Jakobus, the original author of Feko, for making me part of the Feko success story;

• Jim Scapa, Founder and CEO of Altair, whose vision made Feko and me part of Altair;

• And many others who supported me directly/indirectly
"Opportunities are rare to come by…

When opportunities are presented, we can take advantage of them, if we work hard and put our minds to it.”
QUESTIONS

DR. C. J. REDDY
cjreddy@altair.com