Christos S. Lavranos

Dr. Electrical & Computer Engineer

Curriculum Vitae

April 2012

INDEX

1. Curriculum Vitae

I. Personal Data

Christos S. Lavranos

Dr. Electrical & Computer Engineer

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e-mail: chlavran@gmail.com
Web page: http://utopia.duth.gr/~chlavran
Origin: Hlomos, Corfu, Greece
Place and Date of Birth: Athens, 02/01/1979
Completion of Military Services: YES – Day of Competition: 18/5/2010

II. Studies

1. Doctor of Philosophy in Electrical & Computer Engineering	Electrical & Computer Engineering Department in Democritus University of Thrace, (D.U.TH.), Greece Dissertation Title: "Electromagnetic Simulation of Non- Planar Structures with a Finite Difference Frequency Domain Method" G.P.A. : Excellent Advisor: Prof. G. A. Kyriacou 2003- 2009
2. Diploma in Electrical & Computer Engineering	Electrical & Computer Engineering Department in Democritus University of Thrace, (D.U.TH.), Greece (5 years of studies) 1997- 2002 G.P.A.: 8.93 out of 10 (first in a class of 141 students)
3. High School Graduation	High school Graduation from Corfu, Greece (grade 18.9/20) 1993-1996

III. Foreign Languages

1. **English**: Cambridge First Certificate in English (Grade B)
2. **German**: Goethe- Institut Zertifikat Deutsch als Fremdsprache

IV. TEACHING EXPERIENCE

DEMOCRITUS UNIVERSITY OF THRACE

1. **ASSISTANT LECTURER (PD 407/1980)** in the Architecture Engineering, Democritus University of Thrace, Xanthi, Greece, in the course of Electromechanological Studies for the academic years **2010 -2011** and **2011 - 2012**

TECHNICAL EDUCATIONAL INSTITUTE (TEI) OF KAVALA – INDUSTRIAL IT DEPARTMENT

2. **RESEARCH ASSOCIATE** in Industrial IT Department of Technical Educational Institute (TEI) of Kavala, Greece, in the courses of Networks I, Object Oriented Programming, Programming Techniques, Electrical Circuits, Introduction to Informatics and Databases for the academic years **2010 – 2011** and **2011 – 2012**

   SUPERVISION OF 2 GRADUATION THESIS DURING THE AC. YEAR 2011-2012

TECHNICAL EDUCATIONAL INSTITUTE (TEI) OF KAVALA - ELECTROLOGY DEPARTMENT

3. **RESEARCH ASSOCIATE** in Electrology Department of Technical Educational Institute (TEI) of Kavala, Greece, in the courses of Telecommunications, Circuits, and Measurements Techniques for the academic year **2011 – 2012**

   SUPERVISION OF 2 GRADUATION THESIS DURING THE AC. YEAR 2011-2012

GREEK PUBLIC TRAINING INSTITUTE (IEK)

4. **TEACHING** in Greek Public Training Institute (IEK) at Software and ArcGIS Courses during the **Ac. Year 2010-2011**

NATIONAL CENTRE FOR PUBLIC ADMINISTRATION & LOCAL GOVERNMENT

5. **MEMBER** OF NATIONAL CENTRE FOR PUBLIC ADMINISTRATION & LOCAL GOVERNMENT

   Giving Seminars:

   «86023T11: Using Word Processors for the Public Administration & Local Government » - **June 2011**

   «86037T11: Basic Knowledge in Computers» - **October 2011**

DEMOCRITUS UNIVERSITY OF THRACE - TEACHING ASSISTANT

6. **TEACHING ASSISTANT** in the Microwaves Laboratory, DUTH, supervised by George A. Kyriacou in the following courses:
   Microwaves, Microwaves Circuit Design, Introduction to Radar Systems [laboratory experiments/ additional supporting theory courses]
   High frequency measurements [laboratory experiments]

   ASSISTANCE IN 4 GRADUATION THESIS DURING THE AC. YEARS 2003-2009

March 2003 – January 2009

V. WORK EXPERIENCE

1. Electrical Engineering Office 2003-2012
2. Adult Education in Software 2010 -2012
3. Soldier in Charge in Computer Network of IV Support Brigade, Greece 2009 –2010
4. IAESTE (International Association for the Exchange of Students for Technical Experience)

   a. Company: Universitat de Valencia, Summer 2001
   Job: Software Administrator at Biology Lab

   b. Company: INTEGRA LTD, Budapest, Summer 2000
   Job: Training at a software house (Programming at Forte, SQL).

VI. RESEARCH EXPERIENCE

RESEARCH PROJECT **THALIS**
IMPLEMENTATION GSRT

1. **POST - DOC RESEARCHER** in research Project "Thales-Design Techniques for Digitally Condoled RF Microwave Structures Appropriate for Software Defined Cognitive Radio" with Supervisor Professor G. A. Kyriacou
   1/1/2012 –

RESEARCH PROJECT **EDUNET**
IMPLEMENTATION ΕΠΕΑΕΚ II

2. **WORKING** at Helpdesk support of Greek School Network with Supervisor As. Professor C. Koukourli
   1/5/2009–30/6/2009

RESEARCH PROJECT **PENED 2003**
IMPLEMENTATION GSRT

3. **PRINCIPAL RESEARCHER** in Research Project «PENED2003» entitled "Software Development for the Electromagnetic Design and Simulation of RF- Microwave Structures" with Supervisor Professor G. A. Kyriacou
   1/12/2005 - 1/12/2008

RESEARCH PROJECT **PYTHAGORAS**
IMPLEMENTATION GSRT

4. **RESEARCHER** in Research Project «PYTHAGORAS» entitled "Smart Antennas Systems for Wireless Communication Networks" with Supervisor Professor G. A. Kyriacou
   1/3/ 2004 – 31/12/2007

RESEARCH PROJECT **PESP**
IMPLEMENTATION ΕΠΕΑΕΚ II

5. **RESEARCHER** in Research Project «PESP» entitled "Assistance of Computer Studies in Democritus University of Thrace" with Supervisor Professor D. Papadopoulo
   a. **01/06/2004 – 31/12/2004**
   In the project "Development and Adaptation of printed and electronic educational material"
   b. **15/5/2007 – 15/11/2007**
   In the project "Development and Adaptation of printed and electronic educational material"
   c. **11/12/2007 – 29/2/2008**
   In the project "Development of laboratory exercises for the 'Microwaves' course "

RESEARCH PROJECT **TSMEDE**
IMPLEMENTATION ΕΠΕΑΕΚ II

6. **RESEARCHER** in the research Project TSMEDE entitled "Improving Laboratory -Computational Infrastructure in the Microwaves Lab" with Supervisor Associate Professor M. Chrisomallis
   01/07/2003 – 15/03/2006

DEMOCRITUS UNIVERSITY OF THRACE - GRADUATE RESEARCH ASSOCIATE

7. Electromagnetic Fields Measurements as well as Network and Spectrum Analyzer Measurements in Eastern Macedonia and Thrace Region. **1/1/2003 -1/6/ 2009**

VII. RESEARCH INTERESTS

1. Computational electromagnetic: Numerical methods for the analysis of microwave circuits like FDTD, FDFD, FEM, MM, MOM. Special interest at Finite Difference Frequency Domain method for general orthogonal curvilinear coordinates.
2. Antenna design and analysis.
3. Microwave Circuits design and analysis.
4. Electromagnetism
5. Numerical Analysis
6. Programming in C/C++, Fortran, Python
7. Algorithms
8. Computer and Communication Networks

VIII. COMPUTER EXPERIENCE

1. **OS**: Excellent knowledge of Windows and Office for PC. Very good knowledge of Unix/Linux
2. **PROGRAMMING**: C/C++, FORTRAN 77/95, Python, Boa, FORTE, MATLAB, SQL
3. **SOFTWARE**: ADS, FEMLAB, CST MICROWAVE STUDIO, CONCERTO, Dreamweaver, Frontpage Express, Eclipse, FINE – 4M, AUTOCAD
4. **TYPING**: Word, LaTeX

IX. HONORS & AWARDS

GREEK ARMY

1. Honor Diploma of Successful Services in Greek Army **2010**

GSRT

2. PENED - E.U Research Fellowship Award for his Ph.D Dissertation **2005**

DEMOCRITUS UNIVERSITY OF THRACE

3. D.U.Th. family Grant for graduating first in Polytechnic School – Class 2002 (300 students) **2002**

TECHNICAL CHAMBER OF GREECE

4. Technical Chamber of Greece Award for excellent engineering students - **2002**

HELLENIC NATIONAL FELLOWSHIP FOUNDATION

5. Hellenic National Fellowship Foundation Award for academic excellence for the first, second, third and fifth year of studies as an undergraduate student **1997-2002**

X. International Acknowledgment

Referee in International Journals	1. Progress in Electromagnetic Research (PIER) 2. Journal of Electromagnetic Waves and Applications (JEMWA)

XI. Scientific Associations & Committees

1. **Member** of Technical Chamber of Greece – No: 96959
2. **Member** of IEEE - No: 41605078
3. **Member** of National Centre for Public Administration & Local Government
4. **Member** of IAESTE (International Association for the Exchange of Students for Technical Experience) during my Studies
5. **Member** of IEEE (Student Branch of Xanthi) during my Studies

XII. Various Skills

Hellenic State Knowledge & Skills Test	Grade 86,75/100
Technical Chamber of Greece	Technical Chamber of Greece : Seminar for "Regulations for Energy Performance of Buildings . **December 2010**
References	Available at Demand

XIII. Hobbies and Activities

Hobbies	1. Painting – Writing Kid's Fairytales 2. Hiking 3. Basketball 4. Travelling
Activities	a. **Member** of Cultural Union of Xanthi (F.E.X.) b. **Member** and Vice President of "GEFYRA" Cultural Union of Polytechnic School of D.u.Th. during my studies

2. Publications

A. Diploma Thesis

Department of Electrical and Computer Engineering, Democritus University of Thrace, Xanthi, Greece
Thesis Title: "Analysis of Microwave Devices using the FDTD method"
Supervisor: Professor G.A. Kyriacou

B. Ph.D. Dissertation

Department of Electrical and Computer Engineering, Democritus University of Thrace, Xanthi, Greece
Dissertation Title: " Electromagnetic Simulation of Non- Planar Structures with a Finite Difference Frequency Domain Method "
Supervisor: Professor G.A. Kyriacou

C. International Journals with Referees

J1. C. S. Lavranos, P.C. Allilomes, K. Zekios, S. Lavdas and G. A. Kyriacou, "Eigenanalysis of Open-Radiating, Periodic and Curved Waveguiding Structures – A Review"**, *URSI Bulletin, under revision.***

J2. C. S. Lavranos, G. A. Kyriacou, "Eigenvalue analysis of curved waveguides employing an orthogonal curvilinear frequency domain finite difference method", IEEE Microwave Theory and Techniques, , vol. 57, no3, pp. 594-611, March 2009.

Citation (1): H.-W. Chang, W.-C. Cheng, and S.-M. Lu, "Layer-mode transparent boundary condition for the hybrid fd-fd method," Progress In Electromagnetics Research, Vol. 94, 175-195, 2009.
Citation (2): George A. Kyriacou, Ilias N. Aitidis, Dimitrios G. Drogoudis and John N. Sahalos (2011). High to Microwave Frequencies Imaging Techniques, Medical Imaging, Okechukwu Felix Erondu (Ed.), ISBN: 978-953-307-774-1, InTech, Available from: http://www.intechopen.com/articles/show/title/high-to-microwave-frequencies-imaging-techniques

J3. C. S. Lavranos and G. A. Kyriacou, "Eigenvalue analysis of curved waveguides employing FDFD method in orthogonal curvilinear co-ordinates," IEE Electronics Letters, vol. 42, issue 12, pp. 702-704, June 2006.

D. International Online Journals with Referees

OJ1. C. S. Lavranos, D. G. Drogoudis, G. A. Kyriacou, "Eigenvalue Analysis of Waveguides and Planar Transmission Lines Loaded with Full Tensor Anisotropic Materials", PIERS Online, vol. 5, no. 5, pp. 471-475, 2009.

OJ2. C. S. Lavranos, G. A. Kyriacou, "A finite difference frequency domain study of curvature lifted modes degeneration", PIERS Online, vol. 3, no. 8, pp. 1208-1212, 2007.

Citation (1): Wilson, Joshua L.; Wang, Cheng; Fathy, Aly E.; Kang and Yoon W., " Analysis of Rapidly Twisted Hollow Waveguides", IEEE Transactions on Microwave Theory and Techniques, vol. 57, issue 1, pp. 130-139.
Citation (2): JL Wilson - Doctoral Dissertations, 2008 "Investigation of Propagation Characteristics of Twisted Hollow Waveguides for Particle Accelerator Applications".

OJ3. C. S. Lavranos and G. A. Kyriacou, "Eigenvalue analysis of curved open waveguides using a finite difference frequency domain method employing orthogonal curvilinear coordinates", PIERS Online, vol. 1, no. 3, pp. 271-275, 2005.

Citation(1): S. J. Lai and B. Z. Wang, "Solving Helmholtz Equation By Meshless Radial Basis Functions Method", Progress In Electromagnetics Research B, Vol. 24, 351-{367, 2010.

E. PROCEEDINGS IN INTERNATIONAL CONFERENCES

C1. S. Lavdas , C.S. Lavranos and G.A. Kyriacou, "Eigenanalysis for Lossy or Open Periodic Structures Incorporating the Floquet Field Expansion" , accepted for PIERS Moscow 2012

C2. G. A. Kyriacou, P. C. Allilomes, C. S. Lavranos, C. L. Zekios and S. Lavdas, "Eigenanalysis of Arbitrarily Shaped 2-D and 3-D Closed and Open-Radiating Structures: A Review" , accepted for PIERS Moscow 2012

C3. S. J. Lavdas, P. Tsompanis, C. S. Lavranos, G. A. Kyriacou and J. N. Sahalos, "Periodic Dipole Array Built on Magnetized Ferrite Could Provide a Tunable DNG Metamaterial?" accepted for the 6th European Conference on Antennas and Propagation - EuCap 2012, Prague, Czech Republic.

C4. S. Lavdas ,C.S. Lavranos and G.A. Kyriacou, "Periodic Structures Eigenanalysis Incorporating the Floquet Field Expansion" , Proc. of the ICEAA IEEE ARWC Conference, Turin, Italy, September, 2011.

C5. C.S. Lavranos, S. Lavdas and G.A. Kyriacou, "Eigenvalue analysis of planar or curved shielded or open transmission lines loaded with full tensor anisotropic materials", Proc. of the ICEAA IEEE ARWC Conference, Turin, Italy, September, 2011.

C6. G.A. Kyriacou, K. Zekios, S. Lavdas, E. Aitidis, C.S. Lavranos and P. Allilomes, " Eigenanalysis of Arbitrarily Shaped 2-D and 3-D Closed and Open-Radiating Structures: A Review", Proc. of the ICEAA IEEE ARWC Conference, Turin, Italy, September, 2011.

C7. S. Lavdas, C. S. Lavranos and G. A. Kyriacou, "A Finite Difference Frequency Domain Method for the Eigenanalysis of Anisotropically Loaded Curved Periodic Structures", Proc. of the 32nd ESA Antenna Workshop, ESTEC, Noordwijk, The Netherlands, October 2010.

C8. Christos S. Lavranos, Dimitrios G. Drogoudis, and George A. Kyriacou, "Eigenvalue Analysis of Waveguides and Planar Transmission Lines Loaded with Full Tensor Anisotropic Materials", Proc. of Progress In Electromagnetics Research Symposium (PIERS) 2009, Moscow, Russia, August 2009.

C9. C. L. Zekios, P. C. Allilomes, C. S. Lavranos and G. A. Kyriacou, "A Three Dimensional Finite Element Eigenanalysis of Reverberation Chambers", Proc. of 2009 EMC Europe Workshop Materials in Applications, Athens, 11-12 June, 2009.

C10. P. A. Economou Filandras, A. P. Orphanides, C. S. Lavranos and G. A. Kyriacou " Mode matching analysis of split ring irises inserted in a circular waveguide," Proc. of Mediterranean Microwave Symposium 2008, Damascus, Syria, pp. 40-45, October 2008.

C11. C. I. Kolitsidas, F. E. Fakoukakis, D. G. Drogoudis, C. S. Lavranos and G. A. Kyriacou, "Development of a Full 3600 azimuth coverage direction of arrival measurement unit", Proc. of Mediterranean Microwave Symposium 2008, Damascus, Syria, pp. 35-39, October 2008.

C12. G. A. Kyriacou, C. S. Lavranos and P.C. Allilomes "Numerical techniques for the eigenanalysis of arbitrary curved and open waveguiding structures", Proc. of International Conference on Mathematical Methods in Electromagnetic Theory 2008 (MMET 08), Odessa, Ukraine, pp. 40-52, 29 June - 02July 2008.

C13. C. S. Lavranos, G. A. Kyriacou, “A multigrid curvilinear discretization for a two-dimensional finite difference frequency domain eigenvalue technique”, Proc. of 13th Biennial IEEE Conference on Electromagnetic Field Computation (CEFC) 2008, Athens, Greece, p. 461, 11-15 May 2008.

C14. C. S. Lavranos, G. A. Kyriacou, “A finite difference frequency domain eigenvalue analysis of curved waveguides loaded with anisotropic materials”, Proc. of 9th International Workshop on Finite Elements for Microwave Engineering, Bonn, Germany, p. 34, 8-9 May 2008

C15. C. S. Lavranos, G. A. Kyriacou, “A finite difference frequency domain study of curvature lifted modes degeneration”, Proc. of Progress In Electromagnetics Research Symposium (PIERS) 2007, Prague, Czech Republic, pp. 188-192, August 2007.

C16. G. Kyriacou, Ch. Lavranos and J. N. Sahalos, Radar electronic countermeasures system in network-centric environment, Proc. of Network-Centric Warfare Conference 2005, Athens, Greece, 2005.

C17. C. S. Lavranos, G. A. Kyriacou, “Eigenvalue analysis of multiconductor transmission lines printed on curved substrate using a FDFD method in orthogonal curvilinear coordinates”, Proc. of Mediterranean Microwave Symposium 2005, Athens, Greece, pp.150-155, September 2005.

C18. C. S. Lavranos, G. A. Kyriacou, “Eigenvalue analysis of curved open waveguides using a finite difference frequency domain method employing orthogonal curvilinear coordinates”, Proc. of Progress In Electromagnetics Research Symposium (PIERS) 2005, Hangzhou, China, pp. 271-275, August 2005.

C19. C. S. Lavranos, G. A. Kyriacou, and J. N. Sahalos, “A 2-D finite difference frequency domain (FDFD) eigenvalue method for orthogonal curvilinear coordinates”, Proc. of Progress In Electromagnetics Research Symposium (PIERS) 2004, Pisa, Italy, pp. 397-400, March 2004.

3. RESEARCH STATEMENT – PH.D. SUMMARY

1. GENERAL RESEARCH ACTIVITY

My general research activity is mainly focused on the above subjects:

i. Computational electromagnetic: Numerical methods for the analysis of microwave circuits like FDTD,FDFD, FEM, MM, MOM. Special interest at Finite Difference method.

ii. Antenna design and analysis.

iii. Microwave Circuits design and analysis.

iv. Electromagnetism

v. Numerical analysis

vi. Programming in FORTRAN / C++ / Python.

and has been brought through the Doctoral Activity and the participation in several Research Programs.

2. DOCTORAL RESEARCH ACTIVITY – PH.D. SUMMARY

In the last three decades the research effort in the area of computational electromagnetics has been extremely increased due to the rapid development of computer systems. This effort was mainly focused on the development of full wave electromagnetic simulators, which are based on the solution of Maxwell's equations using advanced numerical techniques. These techniques are capable of accurate handling electrically large electromagnetic devices. Thus, the direct solution of the Maxwell equations can reproduce in detail the functionality of a structure and the underlying phenomena. This simplifies and shortens the time needed for the design of new electromagnetic devices, as there is no need to construct a whole series of prototypes until the desired behavior is achieved. So, accurate and versatile electromagnetic simulators, apart from their significance on studying new electromagnetic phenomena, have also considerable economic impact.

One of the most mature and robust numerical technique used with great success in electromagnetic analysis is the Finite Difference method, formulated either in time (FDTD), or in frequency domain (FDFD). This method has many of the feature needed for the construction of general purpose electromagnetic simulators. The unique advantage of finite difference method is its easy and convenient employment in any case without any preprocessing requirements, even when complicated anisotropic material inhomogeneous loading is involved. On the other hand, the main drawback of almost all proposed finite difference frequency domain methods is the restriction to geometries described by a Cartesian scheme discretized on a rectangular grid.

My Ph.D. research was focused on formulating the finite difference method in orthogonal curvilinear coordinates, and particularly on the establishment of a two dimensional curvilinear finite difference frequency domain eigenvalue method. By the term “eigenvalue method” we refer to the estimation of complex propagation constants (eigenvalues) and the extraction of their corresponding field distributions (eigenvectors). It is well known that a plethora of microwave devices can be considered as comprised of waveguiding sections. Indicative classical examples are filters, power dividers, diplexers and directional couplers. Even horn radiators may be effectively approximated by a cascaded series of waveguide sections. Hence, the knowledge of the corresponding waveguiding structure characteristics and particularly their

propagation constants (eigenvalues) is inevitable for the design of such microwave devices. The main motive of my Ph.D. research effort was the Finite Difference method disengagement from the Cartesian coordinates, as well as the importance of the eigenvalue analysis in the complete characterization of curved waveguiding structures. Thus, its primary aim was the extension of an original FDFD method for the eigenanalysis (eigenvalue problem solution) of curved waveguiding structures loaded with inhomogeneous and/or anisotropic full tensor materials. For that reason, Maxwell's curl equations are expressed in orthogonal curvilinear coordinates and are discretized by means of an orthogonal curvilinear finite difference grid. The set of two discretized Maxwell's equation in conjunction with the boundary conditions and the propagation assumption along the third axis (which can be curvilinear), lead to a 2-D eigenvalue problem formulated for the complex propagation constants and the corresponding fields distributions of curved structures. Due to the frequency domain formulation multiple grids of different curvilinear coordinate system and/or density can be simultaneously used. That leads to a conformal discretization of curved waveguiding structures having arbitrary cross section and/or fine geometry features, without the Cartesian finite difference main drawback, namely the "stair case" effect.

The main origin and contribution of this work refers the global direct space discretization in curvilinear coordinates, while the present method can handle curvature in all directions, including the propagation one. First priority of this work was the formulation of the method for closed-shielded structures. In parallel, several efforts for the extension of our method for open-radiating structures have been made. These were based on a combination of the FDFD method with the Perfectly Matched Layer (PML). An inherent feature of the elaborated FDFD method is the well known Finite Difference ability of handling anisotropic materials. In particular, its matrix-format implementation in conjunction with its formulation with complex arithmetics enables the introduction of anisotropic materials, including their losses, through a simple modification of the corresponding permittivity or permeability matrices. Thus, the complex matrix-format ability enables the simulation of open-radiating geometries through the introduction of the well known PML complex tensor. In this work these two abilities are exploited for the accurate simulation of arbitrarily shaped curved shielded or radiating geometries full or partially loaded with full tensor anisotropic materials. These materials can be full tensor anisotropic media, ferroelectrics or magnetized ferrites, or even artificial metamaterials, provided that their complex tensors constitutive parameters are available.

The numerical results of this work can be classified into two main categories. Initially, a variety of straight and curved microwave structures were simulated for verification reasons (comparison with analytical solutions, already published results and results obtained by an electromagnetic simulator). Moreover, a series of complex curved microwave structures, which analysis was almost impossible with the available techniques, were simulated exclusively with the proposed method. The results for the curved structures were compared with those of the corresponding straight geometries (having same cross section) for the investigation of significant curvature effects, such as dispersion curves shifting, modes degeneration lifting and modes coupling.

3. RESEARCH PROJECTS

I have been participated in several Research Projects funded by the Greek Government and the EU. The most important are the following two:

Principal Researcher in Research Project «PENED2003» entitled "Software Development for the Electromagnetic Design and Simulation of RF- Microwave Structures" (December 2005 - November 2008).

Researcher in Research Project «PYTHAGORAS» entitled "Smart Antennas Systems for Wireless Communication Networks". (March 2004 - December 2007).

4. PENED & PYTHAGORAS RESEARCH PROJECTS

1. ABSTRACT OF RESEARCH PROJECT PENED 2003 ENTITLED " SOFTWARE DEVELOPMENT FOR THE ELECTROMAGNETIC DESIGN AND SIMULATION OF RF-MICROWAVE STRUCTURES "

This project aimed at the **electromagnetic simulation and design of RF-microwave devices**. The developed software combined a variety of 2-D or 3-D numerical methods for the microwave devices electromagnetic simulation. The general framework of the project can be shown in the above figure, where the software outline is depicted.

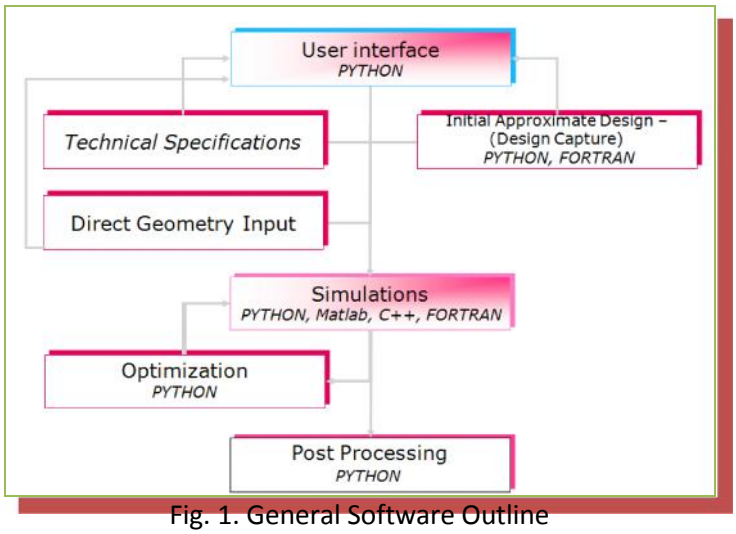

Fig. 1. General Software Outline

The primary design was based on approximated solutions, while a finally optimization based on adjoined networks was also used. Special attention was paid at the design of microwave feeding networks of conformal antenna arrays.

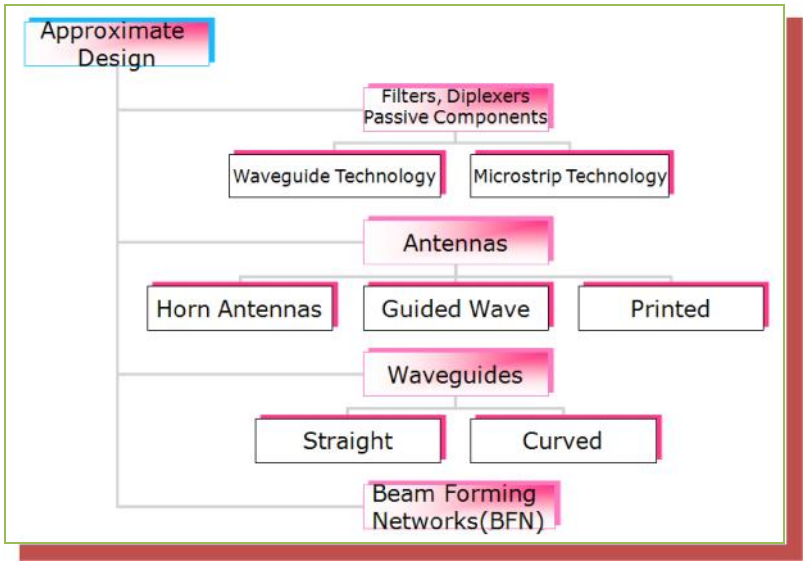

Fig. 2. Approximate Design

As mentioned above, the main part of this project was the microwave devices Electromagnetic Simulation. The numerical methods used for that scope were mainly the Finite Element Method (FEM), the Finite Difference Frequency Domain Method (FDFD) and the Mode Matching Method. In addition, a variety of other techniques, such as the DtN (Dirichlet to Newmann) mapping and the DoA (Direction of Arrival) Estimation algorithm were used. These methods were programmed in C/C++ , FORTRAN 90 and MATLAB.

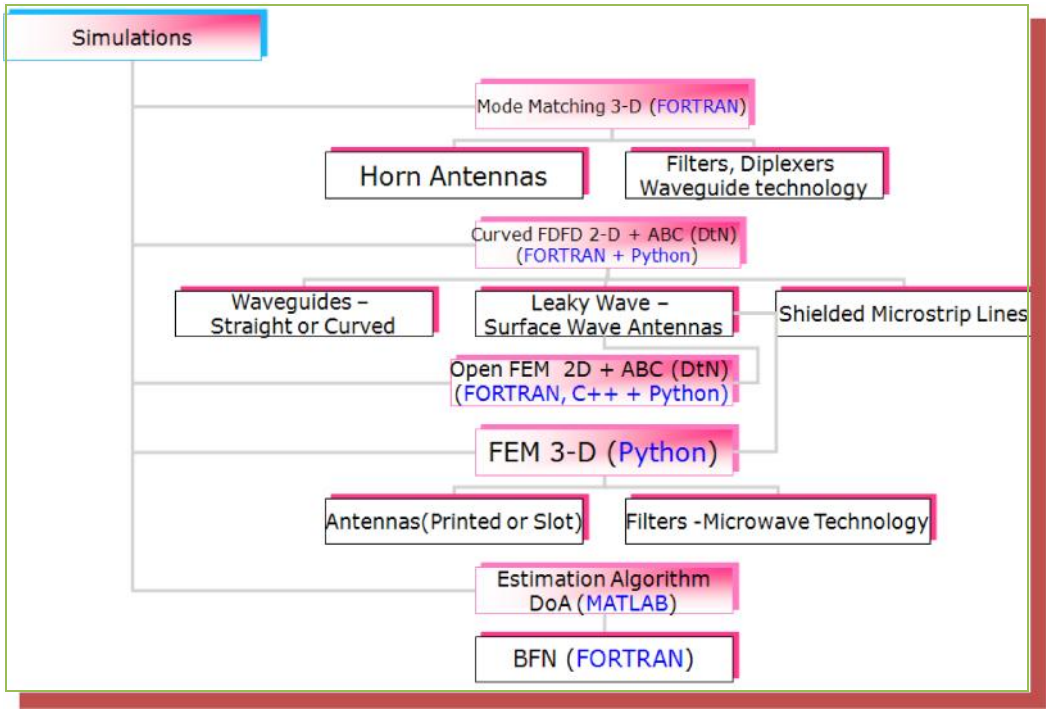

Fig. 3. Utilized Software

This work combined three PhD dissertations and was funded from the General Secretariat for Research and Technology, Greece and the European Union FP3 (PENED 2003).

2. Abstract of Research Project Pythagoras entitled " Development of an Adaptive and a Switched Beam Smart Antenna System for Wireless Communications "

Two alternative system design configurations for point-to-multipoint Smart Antenna Architecture were studied during this project. Both systems were designed for use in the 2.45 GHz ISM Band.

The first one was a fully passive approach, employing the Butler Matrix beamformer in a 2-D configuration, implementing a Switched-Beam point-to-multipoint system, as shown in Fig. 1. This system was able to steer the beam in a 3-D space, by properly feeding a planar array.

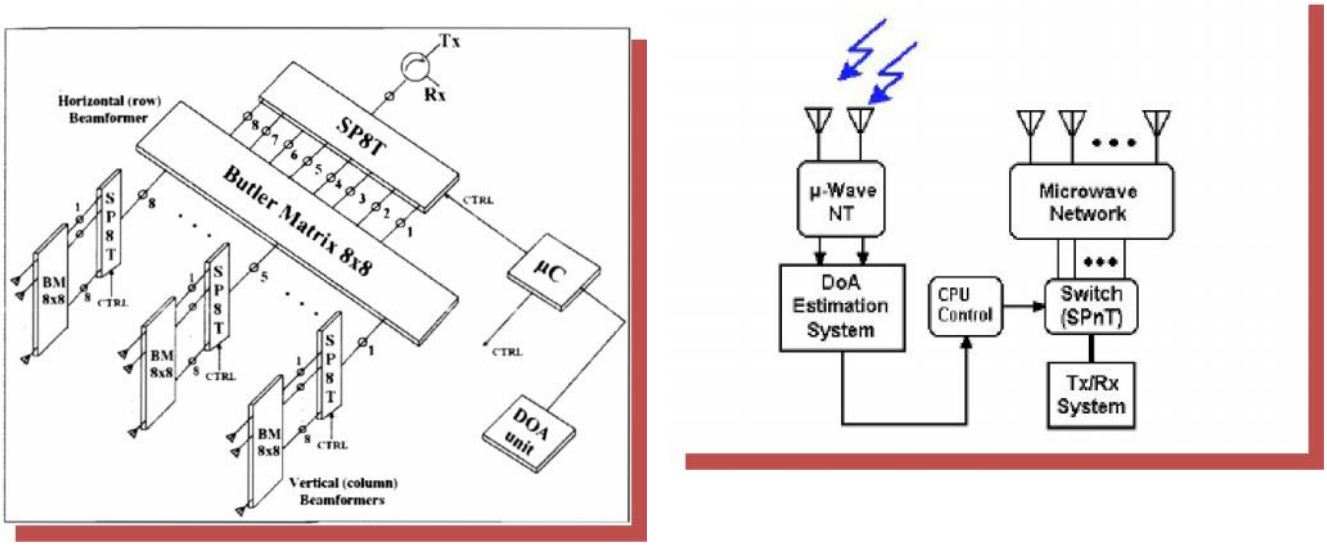

Fig.1 Architecture of the proposed Switched Beam Smart Antenna Systems.

The second system adopted partially the Adaptive approach using Vector Modulators instead of the Butler Matrix for the beam-steering in one of the scanning planes, as shown in Fig. 2.

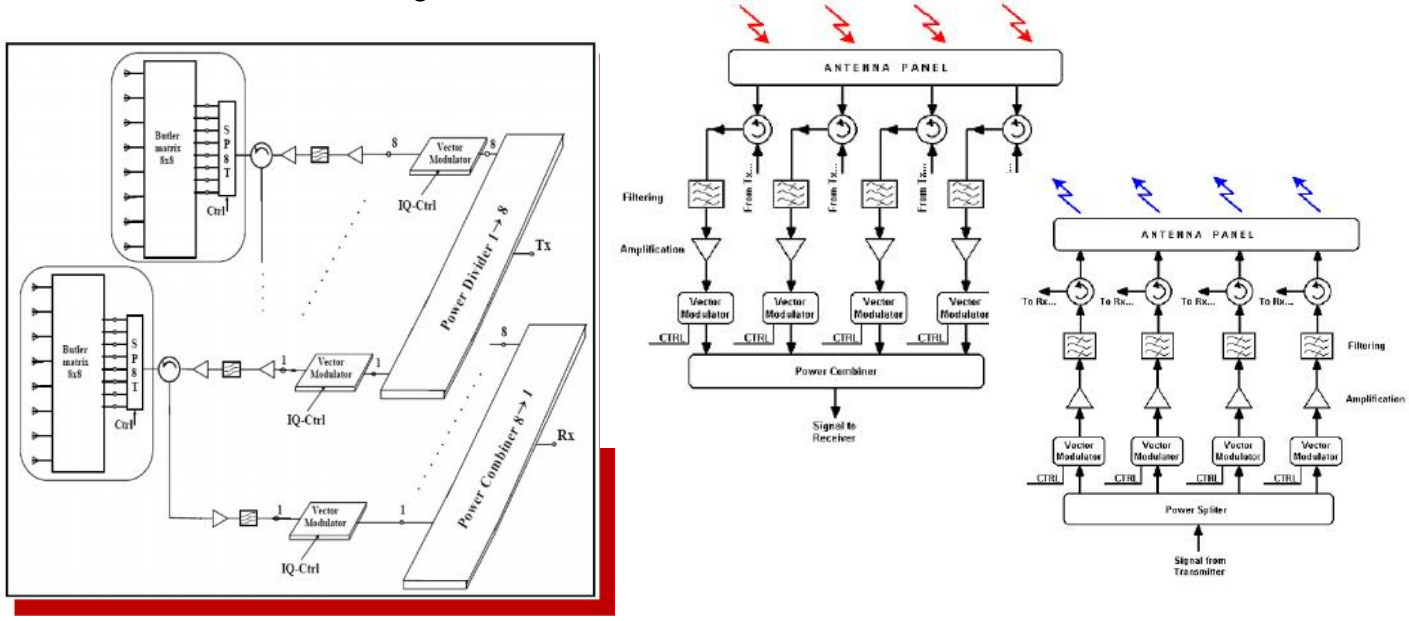

Fig.2 Architecture of the proposed Adaptive System.