

KEZHONG ZHAO

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EDUCATION:

DOCTOR OF PHILOSOPHY, Electrical Engineering.

Expected Graduation Date: December 2006.

The Ohio State University, Columbus, Ohio

Diss. title: *Time Domain Domain Decomposition Methods for Large Electromagnetic Problems*

Advisor: Prof. Jin-Fa Lee

MASTER OF SCIENCE in Electrical Engineering, Winter 2003.

The Ohio State University, Columbus, Ohio.

G.P.A. 3.89/4.0

Thesis title: *Single Level Dual Rank SVD Algorithm For Multilayer Radiation And Scattering Problems*

Advisor: Prof. Jin-Fa Lee

BACHELOR OF SCIENCE in Electrical Engineering, June 2001.

The Ohio State University, Columbus, Ohio.

G.P.A. 3.92/4.0, *Summa Cum Laude* .

RESEARCH EXPERIENCE:

10/04 to present *GRADUATE RESEARCH ASSOCIATE*

ElectroScience Laboratory, The Ohio State University, Columbus, Ohio.

Worked on various research topics some of which include the following:

- Formulation and development of time domain *domain decomposition method*.
- Formulation and development of frequency domain and time domain higher order *absorbing boundary condition*.
- Development and Implementation of novel symmetric domain decomposition based hybrid FEM-BEM coupling. Its properties include internal resonance free, positive definite, modularity, and non-conformity between FEM and BEM domain.
- Development and implementation of SVD based block CG algorithm.

09/03 to 10/04 *NORTHROP GRUMMAN CORPORATION FELLOW*

ElectroScience Laboratory, The Ohio State University, Columbus, Ohio.

Worked on various research topics some of which include the following:

- Development and implementation of a novel *Fast Finite Element Tearing and Interconnecting Like Domain Decomposition Method*, for finite periodic arrays.
- Analysis and development of a *Domain Decomposition Method, based on a generalized Robin transmission condition, for non-conforming finite element methods*. The codes resulted from this work were applied to the analysis of large finite periodic arrays.

09/01 to 09/03 *GRADUATE RESEARCH ASSOCIATE*
ElectroScience Laboratory, The Ohio State University, Columbus, Ohio.

Worked on various research topics some of which include the following:

- Formulation and development of fast *Integral Equation* solvers including *IE-QR* algorithm and *Adaptive Cross Approximation (ACA)* algorithm for the solution of three-dimensional electromagnetic radiation and scattering problems.
- Applications of multi-layer Green's function and Loop Star basis functions.

HONORS AND AWARDS:

6/03 URSI Student Paper Competition Award.

12/03 Best Thesis of 2003 in ElectroScience Lab, The Ohio State University.

COMPUTER EXPERIENCE:

- Good knowledge of PC's (Windows 2000/NT/98/95 and LINUX).
- Programming Languages: C++, C, Fortran 77/90.
- Mathematical Tools: MATLAB and MAPLE V.
- EM/CAD Software Packages: AutoCAD, AC3D, CADKEY, ADS.
- Typesetting/Word Processors: *Microsoft Word*.

COURSEWORK:

GRADUATE

MAT 601 Mathematical Principles for Scientists I	EE 714 Radar
MAT 602 Mathematical Principles for Scientists II	EE 719 Electromagnetic Field Theory 1
MAT 603 Mathematical Principles for Scientists III	EE 723 Microwave Transistor Amplifiers
EE 813 Finite Elements for Electromagnetics	EE 810 Electromagnetic Field Theory 2
EE 814 Method of Moments in Electromagnetics	EE 817 Advanced Electromagnetic Theory 1
EE 815 Advanced Antenna Theory	EE 818 Advanced Electromagnetic Theory 2
EE 894P Advanced Integral Equations	EE 819 Advanced Electromagnetic Theory 3
CIS 621 Intro. to High-Performance Computing	EE 620 Microelectronics

UNDERGRADUATE (selected)

Telecommunications Systems I and II	Electromagnetic Compatibility
Power Electronic Devices and Circuits	Microwave Circuits
Analog Integrated Circuits	Antennas
Partial Differential Equations	Linear Algebra
Probability Theory	Complex Analysis

MEMBERSHIPS:

9/01 to present *Student Member* of the IEEE, (AP-S).

9/99 to present Life Member of Golden Key National Honor Society.

HOBBIES:

Literature, Movie, Music, Chinese Chess.

REFERENCES:

Available upon request.

JOURNAL PUBLICATIONS:

- M. N. Vouvakis, K. Zhao, and J. -F. Lee, "FEM Analysis of Infinite Periodic Structures with Non-Matching Triangulations", *IEEE Transactions on Magnetic*, submitted.
- K. Zhao, M. N. Vouvakis, and J. -F. Lee, "Solving Electromagnetic Problems Using A Novel Symmetric FEM-BEM Approach", *IEEE Transactions on Magnetic*, submitted.
- K. Zhao, M. N. Vouvakis, and J. -F. Lee, "The Adaptive Cross-Approximation Algorithm for Accelerated Method of Moments Computations of EMC Problems", *IEEE Transactions on Electromagnetic Compatibility*, in press.
- S.-C. Lee, M. N. Vouvakis, K. Zhao and J.-F. Lee, "Analyzing Microwave Devices Using a Symmetric Coupling of Finite and Boundary Elements", *International Journal for Numerical Methods in Engineering*, vol. 64, no. 4, pp. 528-546, Sept., 2005.
- M. N. Vouvakis, S.-C. Lee, K. Zhao and J.-F. Lee, "A Symmetric FEM-IE Formulation with a Single-Level IE-QR Algorithm for Solving Electromagnetic Radiation and Scattering Problems", *IEEE Transactions on Antennas and Propagation*, vol. 52, pp. 3060-3070, Nov. 2004.
- K. Zhao, and J. -F. Lee, "A Single-Level IE-QR Algorithm to Model Large Microstrip Antenna Arrays", *IEEE Transactions on Antennas and Propagation*, vol. 52, pp. 2580-2585, Oct. 2004.

CONFERENCE PUBLICATIONS:

- K. Zhao, M. N. Vouvakis, S. M. Seo, S.-C. Lee, and J.-F. Lee, "A Symmetric Domain Decomposition Formulation of Hybrid FEM-BEM Coupling for Electromagnetic Analysis", (*invited paper*), *EMC Zurich*, Singapore, Feb. 28-Mar. 3, 2006.
- K. Zhao, and J.-F. Lee, "An Accelerated Non-Conforming DP-FETI Domain Decomposition Method for the Analysis of EMC Problems", *EMC Zurich*, Singapore, Feb. 28-Mar. 3, 2006.
- K. Zhao, M. N. Vouvakis, and J.-F. Lee, "Application of DP-FETI Domain Decomposition Method for the Negative Index of REfractive Materials", *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Washington D. C, July, 2005.
- S. M. Seo, K. Zhao, M. N. Vouvakis, and J.-F. Lee, "A Symmetric FEM-BEM Approach for Solving Electromagnetic Problems", *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Washington D. C, July, 2005.
- K. Yuan, K. Zhao, and J.-F. Lee, "A SVD Based BCG Algorithm for Speeding Up Monostatic RCS Computations", *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Washington D. C, July, 2005.
- K. Zhao, M. N. Vouvakis, S.-C. Lee, and J.-F. Lee, "Solving Electromagnetic Problems Using A Novel Symmetric FEM-BEM Approach", *Compumag*, Shengyang, China, Jun. 26-30, 2005.
- M. N. Vouvakis, K. Zhao, and J.-F. Lee, "FEM Analysis of Infinite Periodic Structures with Non-Matching Triangulations", *Compumag*, Shengyang, China, Jun. 26-30, 2005.
- K. Zhao, M. N. Vouvakis, and J.-F. Lee, "Application of the Multilevel Adaptive Cross-Approximation on Ground Plane Designs", *IEEE EMC Symposium*, Santa Clara, CA, Aug. 9-14, 2004, pp. 124-127.
- K. Zhao, M. N. Vouvakis, and J.-F. Lee, "The Multilevel Adaptive Cross-Approximation Algorithm For Modeling Electromagnetic Radiation and Scattering Problems", *PIERs*, Nanjing, China, Aug. 28-31, 2004.
- K. Zhao, M. N. Vouvakis, S. -C. Lee, and J.-F. Lee, "Domain Decomposition Method in Conjunction with DP-FETI for Modeling Large Finite Arrays", *PIERs*, Nanjing, China, Aug. 28-31, 2004.
- M. N. Vouvakis, K. Zhao, and J.-F. Lee, "Modeling Large Almost Periodic Structures Using a Non-Overlapping Domain Decomposition Method", *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Monterey, CA, Vol. 1, pp. 343-346, June, 2004.

K. Zhao, M. N. Vouvakis, S.-C. Lee, and J.-F. Lee, "An Ultimate DDM with Mortar Techniques for Solving Large EM Problems – 1 billion Unknowns on a PC", *PIERs*, Pisa, Italy, Mar. 28-31, 2004.

M. N. Vouvakis, S.-C. Lee, K. Zhao, and J.-F. Lee, "A Symmetric FEM-IE Formulation using a Single Level IE-QR Algorithm", (*Invited paper*), in *Proceedings of the International Conference on Electromagnetics in Advanced Applications*, Torino, Italy, Vol. 1, pp. 111-114, Sept, 2003.

M. N. Vouvakis, S.-C. Lee, K. Zhao, and J.-F. Lee, "Hybrid FEM/IE Formulation using a Single Level QR Algorithm", EMCC 2003, NASA Langley Research Center, Hampton Virginia, May 20-22, 2003.

M. N. Vouvakis, S.-C. Lee, K. Zhao, and J.-F. Lee, "Speed up the hybrid FEM+IE formulation using a low-rank matrix approximation", (*Invited paper*), *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Columbus, OH, Vol. 2, pp. 124-127, July, 2003.

M. N. Vouvakis, S.-C. Lee, K. Zhao, and J.-F. Lee, "Hybrid FEM/IE Formulation using a Single-Level Low-Rank IE-QR Algorithm", (*Invited paper*), Mathematics of Finite Elements and Applications (MAFELAP), Brunel Institute of Computational Mathematics, UK, pp. 109, June 21-24, 2003.

K. Zhao, and J. -F. Lee, "An $O(N^3/2)$ MoM Computation of Electromagnetic Radiation and Scattering Problems Using A Novel 2-Level IE-SVD Algorithm", *IEEE Antennas Propagat. Society Internat. Symp. Digest*, Columbus, OH, July, 2003.

K. Zhao, and J. -F. Lee, "Using star loop method of moment to model arbitrary shaped microstrip antennas", *Compumag*, Saratoga Springs, New York, July 14-17, 2003.