Rafi L. Muhanna

Associate Professor

Georgia Institute of Technology
School of Civil and Environmental Engineering

I. Earned Degrees

1979 Ph.D.: Higher Institute for Structure and Architecture, Sofia, Bulgaria. Civil Engineering, with major in Solid and Structural Mechanics.

1976 M.Sc.: Higher Institute for Structure and Architecture, Sofia, Bulgaria. Structural Engineering

1972 B.Sc.: University of Damascus, Damascus, Syria. Civil Engineering, five-year program

II. Employment

2000 – present:
Associate Professor, Civil Engineering, Georgia Tech Savannah with joint appointment in the School of Civil and Environmental Engineering, Georgia Institute of Technology

1993 – 2000:
Visiting Associate Professor, Civil Engineering, University of Maryland, College Park, Maryland.

1991 – 1992:
Visiting Associate Professor, Civil Engineering, Case Western Reserve University, Cleveland, Ohio.

1988 – 1991:
Associate Professor, Civil Engineering, University of Sana'a, Sana'a, Yemen. On a three-year leave of absence from University of Damascus, helped the Faculty of Engineering of the University of Sana'a develop the educational program and establish laboratories.

1979 – 1988:
Assistant Professor and Associate Professor, Civil Engineering, University of Damascus, Syria**.**

III. Teaching

A. Individual Student Guidance

In Process:

Postdoctoral fellow:

Dr. Ayse Erdolen, Assistant Professor, Department of Civil Engineering, Yildiz Technical University, Istanbul, Turkey Spring 2007)

Ph.D. Guoqing Xu, CEE, Georgia Tech, Fall 2006
Project title: "Nonlinear Finite Element Analysis Under Uncertainty with Limited Information."

Graduated:

Ph.D. **Hao Zhang**, CEE, Georgia Tech, Fall 2001
Thesis title: "Non-deterministic Linear Static Finite Element Analysis: An Interval Approach."
Defense date: August 18, 2005
Employer: Uzun and Case, Atlanta, Georgia

M.S. **Vishal Saxena**, CEE, Georgia Tech, Fall 2002
Thesis title: "Interval Finite Element Analysis for Load Pattern & Load Combination."
Defense date: August 11, 2003

M.S. **Samir Maasarani**, University of Damascus
Thesis title: "Analysis of Space Trusses and Frames by FEM."
Developed computer programs, implemented new algorithms.
Defense date: May, 1987

M.S. **Mohammad Zouhayli**, Civil Engineering, University of Damascus
Thesis title: "Analysis of Shells of Revolution by FEM; Effect of Thickness, Rise and Support Conditions. " Developed computer programs, implemented new algorithms, and created nomograms for structural design.
Defense date: March, 1986

1980 – 1988 **At University of Damascus, Syria**
Directed **forty senior student projects**, consisting of complete analysis and design of industrial and high-rise buildings, schools, hospitals, shell structures and other types of structures.

1988 - 1991 **At University of Sana'a, Yemen**
Directed **twelve senior student projects** on computer-aided analysis and design of space structures; and characterization of local building materials–adobe, local brick, stone, aggregates, cement–for their importance in the Yemeni architecture and use in construction.

B. Other Teaching Activities

2000 - 2003 **At Georgia Institute of Technology**
Developed complete electronic course notes for five courses at Georgia Tech including:

- CEE3040: Fluid Mechanics, course taught one time since 2000.
- CEE3030: Strength of Materials, course taught 4 times since 2001.
- CEE3055: Structural Analysis, course taught 4 times since 2001.

- CEE3770: Statistics & Applications, course taught one time, spring 2003.
- CEE4550: Structural Analysis II, course taught one time since 2001.

Courses are in PDF and PowerPoint formats with full animation, ready for use in distance and conventional education.

Coordinator of CEE undergraduate course offering, GTSAV, that includes: planning for seven semesters, offering design, and scheduling. (Fall 2002-2004)

Coordinator of CEE graduate course offering at GTSAV, that includes: planning and offering design. (Fall 2002-2004)

1988 – 1991 At University of Sana'a, Yemen

Established and administered the Structural and Materials Laboratory. The Laboratory was equipped with state of the art testing machines. It contains facilities and several servo-controlled testing machines of varying sizes and capacities such as:

- Universal testing machines
- Column testing machine
- Creep testing machine
- Earthquake-loading simulator
- A strong floor facility
- High stiffness frame
- Dynamic test frame
- Cyclic test frame

The Lab can handle full-scale tests on structural elements and assemblies, and the machines can accommodate large-scale models of structures to be tested under complex realistic loading conditions.

Established a structural and material testing program for senior undergraduates. This program started with the testing of local building materials: adobe, local brick and conventional stone, aggregates, cement and structural elements (concrete and masonry).

1979 - 1988 At University of Damascus, Syria

Developed two new structural courses for School of Architecture:

- Strength of Materials for Architects, taught 4 times.
- Structural Analysis for Architects, taught 4 times.

After 1984, actively participated in planning, establishing and implementing the graduate program at the Department of Civil Engineering.

IV. Scholarly Accomplishment

A. Published Books and Parts of Books

Editor, Proceedings of the NSF Reliable Engineering Computing Workshop on "Reliable Engineering Computing, " Georgia Tech, September 2004, 417 pp.

Muhanna, R. L. and Mullen, R. L., *Interval Methods for Reliable Computing*, Chapter in Reliability Design Handbook, CRC Press LLC, ISBN 0-8493-1180-2, edited by Efsratios Nikolaidis and Dan Ghiocel, 2005

Editor, Proceedings of the NSF Reliable Engineering Computing Workshop on “Reliable Engineering Computing, ” Muhanna, Georgia Tech, February 2006, 483 pp.

Guest Editor, Special issue of Reliable Computing Journal on Reliable Engineering Computing, Vol. 12, No. 6, December 2006 (part I)

Guest Editor, Special issue of Reliable Computing Journal on Reliable Engineering Computing, Vol. 13, No. 1, February 2007 (part II)

Guest Editor, Special issue of Reliable Computing Journal on Reliable Engineering Computing, Vol. 13, No. 2, April 2007 (part III)

B1. Refereed Journal Publications

Muhanna, R. L. "The Analysis of Shallow Shells by Finite Element Method, J. *Construction* (Bulgaria), Vol. 7, 1978.

Muhanna, Raif L., Muhanna, Rafi L., and Muhanna, Z. L., "Construction System with Natural Stone in Syria, " Journal *Architektur* (Germany), Vol. 7, 1988.

Muhanna, R. L., "A New Assumed Natural Strain Formulation of the Shallow Shell Element," *Communications in Numerical Methods in Engineering*, Vol. 9, pp 989-1004, 1993.

Muhanna, Rafi L., Ayyub, Bilal M. "Uncertainty Analysis of Structural Strength of Stiffened Panels," *Naval Engineers Journal*, Vol. 108, No. 3, pp 399-418, 1996.

Mullen, R. L. and Muhanna, R. L. "Bounds of Structural Response for All Possible Loadings, "*Journal of Structural Engineering, ASCE*, Vol. 125, No. 1, pp 98-106, 1999.

Muhanna, R. L. and Mullen, R. L., "Formulation of Fuzzy Finite Element Methods for Mechanics Problems, " *Computer-Aided Civil and Infrastructure Engineering* (*previously Microcomputers in Civil Engineering*), Vol.14, pp 107-117,1999. **(Invited contribution)**

Muhanna, R. L. and Mullen, R. L., "Treatment Of Geometric Tolerances In Finite Element Analysis," *International Journal of Advanced Manufacturing Systems,* Vol. 4, No. 1, pp 143-162, 2001. **(Invited contribution)**

Muhanna, R. L. and Mullen, R. L., "Uncertainty in Mechanics Problems - Interval-Based Approach, "*Journal of Engineering Mechanics, ASCE,* Vol. 127, No. 6, pp 557-566, 2001.

Muhanna, R. L., Mullen, R. L., and Zhang, H., "Penalty-Based Solution for the Interval Finite Element Methods, "*Journal of Engineering Mechanics,* ASCE, Vol. 131, No. 10, pp.1102-1111, 2005.

Modares, M., Mullen, R., L. and Muhanna, R. L. " Natural Frequency of a Structure with Bounded Uncertainty, "*Journal of Engineering Mechanics,* ASCE, Vol. 132, No. 12, pp. 1363-1371, 2006.

Pereira, S., Mello, U., Nelson, M., and Muhanna R., L. "Uncertainty in Thermal Basin Modeling: An Interval Finite Element Approach, " *Journal of Reliable Computing, Springer Netherlands,* Vol. 12, No. 6, pp. 451-470, December 2006.

Mehdi Modares, Robert Mullen, Paul X. Bellini, and Rafi L. Muhanna, "Buckling Analysis of Structures with Interval Uncertainties", *SAE Transactions Journal of Passenger Cars – Mechanical Systems*, pp. 284-290, March 2006.

Muhanna, R., Mullen, R., and Zhang, H., "Interval Finite Element as a Basis for Generalized Models of Uncertainty in Engineering Mechanics," *Reliable Computing Journal, Springer Netherlands*, Vol. 13, No. 2, pp. 173-194. (to appear April 2007).

Muhanna, R. L., Mullen, R. L., and Zhang, H.," Combined Axial and Bending Stiffness in Interval Finite Element Methods," *Journal of Structural Engineering,* ASCE.(**in press**)

Zalewski, B.F., Mullen, R. L. and Muhanna, R. L., "Interval Boundary Element Method in the Presence of Uncertain Boundary Conditions, Integration, and Truncation Errors, " *Journal of Engineering Analysis with Boundary Elements*. **(Submitted**)

B2. <u>Refereed Conference Papers</u> (at least 2 reviews of complete papers)

Mullen, R. L. and Muhanna, R. L., "Interval Based Finite Element Methods, " Recent Advances in Numerical Methods and Applications, editors: Iliev O. P., Kaschiev M. S., Margenov S. D., Sendov Bl. H., Vassilevski P. S., World Scientific Publishing Co. Pte. Ltd., 1999.

Mullen, R. L. and Muhanna, R. L. "Efficient Interval Methods for Finite Element Solution," Proceedings of the High Performance Computing Systems and Applications, IEEE, editors: Almhana J. N. and Bhavsar V. C., 2002.

Modares, M., Mullen, R., Muhanna, R., and Zhang, H., "Buckling Analysis of Structures with Uncertain Properties and Loads Using an Interval Finite Element Method," Proceeding of NSF Workshop on Reliable Engineering, Georgia Tech, Savannah, GA, 2004.

Muhanna, R., Mullen, R. and Zhang, H., "Interval Finite Element as a Basis for Generalized Models of Uncertainty in Engineering Mechanics," Proceeding of NSF Workshop on Reliable Engineering, Georgia Tech, Savannah, GA, 2004.

Modares, M., Mullen, R., Bellini, P., and Muhanna, R., “Buckling Analysis of Structures with Interval Parameters,” Proceeding of the 2005 SAE World Congress, Reliability and Robust Design in Automotive Engineering, Detroit, Michigan, April 11-14, 2005.

Zhang, H., Muhanna, R. Mullen, R., "Finite Element Analysis for Uncertain Structures: An Interval Approach," Proceedings of the 9th International Conference on Structural Safety and Reliability (ICOSSAR 2005), Rome, Italy, June 19-23, 2005.

Rafi L. Muhanna, Ayše Erdolen and Robert Mullen, “Geometric Uncertainty in Truss Systems: An Interval Approach”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

Rafi Muhanna, Vladik Kreinovich, Pavel Solin, Jack Chessa, Roberto Araiza, and Gang Xiang, “Interval Finite Element Methods: New Directions”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

B.F. Zalewski, R.L. Mullen, R.L. Muhanna, “Boundary Element Analysis of Systems UsingInterval Methods”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

C. Other Publications

Muhanna, R. L., AL-Hasan, A., and AL-Jabri, L., "New Aspects of a Traditional Material, "Symposium of Low Cost Rural Housing, Dara'a, Syria, September 1982.

Muhanna, R. L., "The Policies of Planning and Design of Earthquake Resistant Constructions," Symposium on December '82 Earthquake Relief and Reconstruction Program, Sana'a, Yemen, April 1989.

Muhanna, R. L., "Local Building Materials and a New System for Houses and Buildings, " The First Symposium on Quality Control of Structures And Building Materials, Sana'a, Yemen, January 1990.

Muhanna, R. L. and Ayyub, B. M. "Modeling Geometric Uncertainties of Continuum Structures for Reliability Assessment Purposes, "proceedings of ISUMA-NAFIPS’95, pp 705-710, September 17-20, 1995.

Muhanna, R. L. and Mullen, R. L. "Development of Interval Based Methods for Fuzziness in Continuum Mechanics, " proceedings of ISUMA-NAFIPS’95, pp 145-150, September 17-20, 1995.

Mullen, R. L. and Muhanna, R. L. "Structural Analysis with Fuzzy-Based Load Uncertainty, " proceedings of the 7th ASCE EMD/STD Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, WP I, MA, pp 310-313, August 7-9, 1996.

Muhanna, R., Ballarini, R. and R. Mullen, "Calculation of Stress Intensity Factors with Fuzzy Loading, " proceedings of the 4-th International Conference on Stochastic Structural Dynamics, University of Notre Dame, Notre Dame, IN, USA, Aug. 6-8, 1998. http://www.nd.edu/~ssd98/.

Mullen, R. L. and Muhanna, R., L., "Interval-Based Geometric and Material Uncertainty for Mechanics Problems," proceedings of the 13th ASCE Engineering Mechanics Division Conference, The Johns Hopkins University, Baltimore, MD, June 13-16, 1999.

Muhanna, R. L. and Mullen, R. L., "Interval based Methods for Load and Stiffness Uncertainty in Computer-Aided Analysis, " proceedings of the 1999 NSF Design & Manufacturing Grantees Conference, Queen Mary, Long Beach, CA, January 5-8, 1999. http://www.usc.edu/dept/ise/NSF/proceedings/.

Mullen, R. L. and Muhanna, R., L., "Sharp Interval Estimates for Finite Element Solutions with Fuzzy Material Properties, " proceedings of the 14th ASCE Engineering Mechanics Conference, The University of Texas at Austin, May 21-24, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Enclosure for Material Uncertainty in Solid and Structural Mechanics-Interval Based Approach, Part II, " proceedings of the Eighth ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability University of Notre Dame, Notre Dame, Indiana July 24-26, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Enclosure for Material Uncertainty in Solid and Structural Mechanics-Interval Based Approach, Part I, " proceedings of the Eighth ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability University of Notre Dame, Notre Dame, Indiana July 24-26, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Rigorous Bounds On Interval Estimates For Finite Solutions With Uncertain Material Properties, " proceedings of the 2000 NSF Design & Manufacturing Research Conference, Vancouver, British Columbia, Canada, January 3-6, 2000.

Mhanna, R. L. and Mullen, R. L., " Critical Issues in the Application of Interval Methods to Finite Element Analysis, " proceedings of SCAN2002, 10th GAMM - IMACS International Symposium on Scientific Computing, Computer Arithmetic, and Validated Numerics, Paris, France, September, 24-27, 2002.

Zhang, H. and Muhanna, R. “Finite Element Analysis for Structures with Interval Parameters,” proceedings of the 9th ASCE joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, New Mexico, July 26-28, 2004.

D. Presentations

D1. Invited Keynote Addresses

Sun HPC Consortium, Phoenix, Arizona, November 15-16, 2003.
Title: Towards Reliable Engineering Computing-Interval Finite Element Methods

Second Scandinavian Workshop on Interval Methods and Their Applications.
Technical University of Denmark, Copenhagen, August 25-27, 2005.
Title: Intervals in Structural Engineering

International NSF Workshop on Finite Element Methods (FEM) and their applications to Science and Engineering. University of Texas, Elpaso, Texas, December 11-15, 2006.
Title: Interval Finite Element Methods: An Overview and Latest Development

D2. Conference Presentations

Muhanna, R. L., AL-Hasan, A., and AL-Jabri, L., "New Aspects of a Traditional Material, "Symposium of Low Cost Rural Housing, Dara'a, Syria, September 1982.

Muhanna, R. L., "The Policies of Planning and Design of Earthquake Resistant Constructions," Symposium on December '82 Earthquake Relief and Reconstruction Program, Sana'a, Yemen, April 1989.

Muhanna, R. L., "Local Building Materials and a New System for Houses and Buildings, "The First Symposium on Quality Control of Structures And Building Materials, Sana'a, Yemen, January 1990.

Muhanna, R. L. and Ayyub, B. M. "Modeling Geometric Uncertainties of Continuum Structures for Reliability Assessment Purposes, " ISUMA-NAFIPS'95, September 17-20, 1995.

Muhanna, R. L. and Mullen, R. L. "Development of Interval Based Methods for Fuzziness in Continuum Mechanics, " ISUMA-NAFIPS'95, September 17-20, 1995.

Mullen, R. L. and Muhanna, R. L. "Structural Analysis with Fuzzy-Based Load Uncertainty, " the 7th ASCE EMD/STD Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, WP I, MA, August 7-9, 1996.

Muhanna, R., Ballarini, R. and R. Mullen, "Calculation of Stress Intensity Factors with Fuzzy Loading, " the 4-th International Conference on Stochastic Structural Dynamics, University of Notre Dame, Notre Dame, IN, USA, Aug. 6-8, 1998.

Mullen, R. L. and Muhanna, R., L., "Interval-Based Geometric and Material Uncertainty for Mechanics Problems," the 13th ASCE Engineering Mechanics Division Conference, the Johns Hopkins University, Baltimore, MD, June 13-16, 1999.

Muhanna, R. L. and Mullen, R. L., "Interval based Methods for Load and Stiffness Uncertainty in Computer-Aided Analysis, " the 1999 NSF Design & Manufacturing Grantees Conference, Queen Mary, Long Beach, CA, January 5-8, 1999.

Mullen, R. L. and Muhanna, R. L., "Interval Based Finite Element Methods, " the 4th International Conference on Recent Advances in Numerical Methods and Applications, Sofia, Bulgaria, August 19-23, 1998.

Mullen, R. L. and Muhanna, R., L., "Sharp Interval Estimates for Finite Element Solutions with Fuzzy Material Properties," the 14th ASCE Engineering Mechanics Conference, The University of Texas at Austin, May 21-24, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Enclosure for Material Uncertainty in Solid and Structural Mechanics-Interval Based Approach, Part I, " the 8th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability University of Notre Dame, Notre Dame, Indiana July 24-26, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Enclosure for Material Uncertainty in Solid and Structural Mechanics-Interval Based Approach, Part II, " the 8th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability University of Notre Dame, Notre Dame, Indiana July 24-26, 2000.

Muhanna, R. L. and Mullen, R. L., "Sharp Rigorous Bounds On Interval Estimates For Finite Solutions With Uncertain Material Properties, " the 2000 NSF Design & Manufacturing Research Conference, Vancouver, British Columbia, Canada, January 3-6, 2000.

Mhanna, R. L. and Mullen, R. L., " Critical Issues in the Application of Interval Methods to Finite Element Analysis, " SCAN2002, 10th GAMM - IMACS International Symposium on Scientific Computing, Computer Arithmetic, and Validated Numerics, Paris, France, September, 24-27, 2002.

Mullen, R. L. and Muhanna, R. L. "Efficient Interval Methods for Finite Element Solution," the 16th Annual Symposium on High Performance Computing Systems and Applications, June 16-19, 2002.

Zhang, H. and Muhanna, R. “Finite Element Analysis for Structures with Interval Parameters,” ASCE joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, New Mexico, July 26-28, 2004.

Modares, M., Mullen, R., Muhanna, R., and Zhang, H., "Buckling Analysis of Structures with Uncertain Properties and Loads Using an Interval Finite Element Method," NSF Workshop on Reliable Engineering, Georgia Tech, Savannah, GA, 2004.

Muhanna, R., Mullen, R. and Zhang, H., “Interval Finite Element as a Basis for Generalized Models of Uncertainty in Engineering Mechanics,” NSF Workshop on Reliable Engineering, Georgia Tech, Savannah, GA, 2004.

Modares, M., Mullen, R., Bellini, P., and Muhanna, R., “Buckling Analysis of Structures with Interval Parameters,” the 2005 SAE World Congress, Reliability and Robust Design in Automotive Engineering, Detroit, Michigan, April 11-14, 2005.
Rafi L. Muhanna, Ayše Erdolen and Robert Mullen, “Geometric Uncertainty in Truss Systems: An Interval Approach”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

Rafi Muhanna, Vladik Kreinovich, Pavel Solin, Jack Chessa, Roberto Araiza, and Gang Xiang, “Interval Finite Element Methods: New Directions”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

B.F. Zalewski, R.L. Mullen, R.L. Muhanna, “Boundary Element Analysis of Systems UsingInterval Methods”, Proceedings of the NSF Workshop on Reliable Engineering Computing, 2006.

D3. Conference Presentations without proceedings

Mullen, R. L. and Muhanna, R., L., "Information Content, Finite Element Analysis, and Interval Methods, "Validated Computing 2002, A SIAM Workshop, Toronto, Canada, May 23-25, 2002.

Muhanna, R. L. and Mullen, R. L., "Critical Issues in the Application of Interval Methods to Finite Element Analysis, " SCAN2002, 10th GAMM - IMACS International Symposium on Scientific Computing, Computer Arithmetic, and Validated Numerics, Paris, France, September 24-27, 2002.

Muhanna, R. L., "Modeling of Engineering Systems Under Uncertainty-Interval-Based Approach, "JANNAF Workshop on Simulation-Based Design in the Face of Uncertainty, July 20, 2003, Huntsville, Alabama.

Muhanna, R. L., Mullen, R. L., and Zhang, H., "Penalty-Based Solution for the Interval Finite Element Methods, "First Scandinavian Workshop on Interval Methods And Their Applications, August 14-16, 2003,Technical University of Denmark, Copenhagen, Denmark.

D3. Seminar Presentations

Invited lecture at Northwestern University, NSF Center for Science and Technology of Advanced Cement-Based Materials, Evanston IL, March 15, 1992.
"Building Materials and Development of Ductile Brick."

Invited lecture at Cleveland State University, Cleveland, Ohio, April 22, 1992.
"Conventional Masonry Building Materials in Contemporary Structural Systems."

Invited lecture at Case Western Reserve University, Cleveland, Ohio, June 5, 1992.
"Finite Element in Shells, A New Assumed Natural Strain Formulation of the Shallow Shell Element."

Invited lecture at Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, November 01, 2002.
"Fundamental Concepts for Interval-based Finite Element Formulations."

Invited lecture at Petrobras Research Center, Rio de Janeiro, Brazil, November, 12, 2002.
"Modeling of Engineering Systems under Uncertainty."

Invited lecture at Georgia Institute of Technology, Department of Civil & Environmental Engineering, Structural graduate seminar, November 25, 2003.
"Reliable Engineering Computing."

E. Other Scholarly Accomplishments

1988 **Patent No. 4219**, May 30, 1988 for "A New System for the Construction of Houses and Buildings using Natural Stone Shells, "Syria.

1996 **Patent,** 60/026085**,** September 13, 1996 "Device and Method for Evaluation of Mechanical Behavior for All Possible Loading Combinations, "U. S., provisional

2001 **Established** the Computational Mechanics Laboratory at GTREP, including:

- A35-WRF2-Sun Fire 280R Server (dual 750 Ultra SPARC-III processors, 8MB E-cache, 4GB memory, two 36GB hard disks).
- Two Sun Blade-100 (500 Mhz/UltraSPARC-Ie, 256 KB L2 Cache, Expert3D-Graphics, 256 Mbyte SDRAM/15-Gbyte Internal).
- Software (Finite Element software, Sun Forte developer including Fortran, C, C++ compilers, and Interval Math Library).

2002 **Established the Center for Reliable Computing (REC), GTSAV**
The center's objectives are the development of methods and tools for reliable engineering computing, the promotion of reliable computing in the different fields of engineering and fostering interdisciplinary collaborations between engineering disciplines, computer science and mathematics on one hand, and with industry on the other hand. In addition, the center will focus on promoting the international effort in this endeavor and will seek to host activities in this aspect. The focus of REC is based on, but not limited to, interval analysis.
http://www.gtrep.gatech.edu/rec/

2003 **Development of Java based interval calculator**
This Interval Calculator is a JAVA-SWING and C++ based application, it can be run locally or as a Web computing tool. Developed by Center of Reliable Engineering Computing (REC), Georgia Tech Savannah. Unlike conventional calculators, this interval calculator is a generalized scientific calculator that works beyond the dimensions of conventional arithmetic and intended for reliable computations. It is capable of displaying computer representations of numbers. Developed to serve as a student learning tool as well as a scientific calculator for engineering community to explore the new dimensions of interval arithmetic in validating computing. It operates under three modes, single/double precision, and their combinations.

V. Services

A. Professional Contributions

United Nations Expert, registered with the Habitat program of the United Nations in the field of low-cost housing and structural design.

Registered Professional Engineer - Syria # 2636, 1976.

EIT, USA, 1993.

Member of the Editorial Board of the **International Journal of Reliability and Safety (IJRS)**

Member of the American Society of Civil Engineers (ASCE)

Member of American Society for Engineering Education (ASEE)

Member of the Joint Army-Navy-NASA-Air Force (JANNAF) Modeling & Simulation Subcommittee

Member of the Syrian Society of Civil Engineers.

Member of the Union of Bulgarian Mathematicians, Bulgarian Academy of Sciences.

Member of the Scientific and Professional Committee, Syrian Society of Engineers.

Reviewer

International Journal of Reliable Computing

American Institute of Aeronautics and Astronautics (AIAA) Journal

International Journal of SOLIDS and STRUCTURES

Journal of Intelligent and Fuzzy Systems

Journal of Computational and Applied Mathematics (JCAM)

Journal of Structural Safety

Member of organizing committee of the Symposium on Rural Housing, organized by the Arab league, Damascus, Syria, 1983. Based on the findings of the symposium, recommended–along with selected members of organizing committee–guidelines for policies, planning and design of rural housing.

Representative of Sana'a University in the organization and recommendation committee of the Symposium on "December '82 Earthquake Relief and Reconstruction Program," Sana'a, Yemen, 1989.

Director of the Seismic Code Design Project of Yemen, 1989 – 1991.

Local Program Coordinator for Global Positioning System in Afar and the South Red Sea Area, an ongoing international project being carried out by French scientific institutions (CNRS, IPG, and IGN) in collaboration with American Universities (MIT, Jet Propulsion Laboratory-CAL Tech), as well as institutions from Belgium, Spain, Italy, Djibouti, Yemen and Ethiopia, 1989 – 1991

Chairman of the organizing committee of the First Symposium on "Earthquakes–Their Impact on Development Plans and Their Hazard Mitigation", Yemen, in collaboration with the United Nations, December 9-11, 1990, Sana'a, Yemen.

Member of local organizing committee, The Joint Third International Symposium on Uncertainty Modeling and Analysis - ISUMA, and the Annual Conference of North American Fuzzy Information Processing Society, University of Maryland, College Park, MD, September 17-20, 1995.

Chairman, Technical session M42, Uncertainty in Engineering Design, The Joint Third International Symposium On Uncertainty Modeling and Analysis (ISUMA) and Annual Conference of the North American Fuzzy Information Processing Society (NAFIPS), University of Maryland, College Park, MD, September, 1995.

Chairman, Technical session W21, Uncertainty in Engineering Design, The Joint Third International Symposium On Uncertainty Modeling and Analysis (ISUMA) and Annual Conference of the North American Fuzzy Information Processing Society (NAFIPS), University of Maryland, College Park, MD, September, 1995.

Member of the international program committee, The 16th Annual International Symposium on High Performance Computing Systems and Applications (HPCS'2002), jointly organized by the Computer Science Department, Moncton University, and the Canadian High Performance Computing Consortium. Moncton, New Brunswick, Canada, June 17-19, 2002.

Organizer and chairman of the organizing committee of the international NSF workshop on Reliable Engineering Computing, hosted by the Center for Reliable Engineering Computing (REC), September 14-17, 2004, Georgia Tech Savannah, Savannah, GA, USA.
Resulted in forming an international consortium for Reliable Engineering Computing (REC) that includes world leaders in the different engineering disciplines, computer science, mathematics, and industry. In addition to thirty four presentations, proceedings of 417 pages and a special issue of Reliable Computing Journal on Reliable Engineering Computing.
http://www.gtsav.gatech.edu/rec/recworkshop/index.html

Organizer and chairman of the organizing committee of the 2nd international NSF workshop on Reliable Engineering Computing, "Modeling Errors and Uncertainty in Engineering Computations,", hosted by the Center for Reliable Engineering Computing (REC), February 22-24, 2006, Georgia Tech Savannah, Savannah, GA, USA.

Resulted in strengthening the international consortium for Reliable Engineering Computing (REC) that includes world leaders in the different engineering disciplines, computer science, mathematics, and industry. In addition to thirty four presentations, proceedings of 483 pages.
http://www.gtsav.gatech.edu/workshop/rec06/index.html

Organizer and chairman of the organizing committee of the 3rd international workshop on Reliable Engineering Computing, "Imprecise Probability in Analysis and Engineering Design,", will be hosted by the Center for Reliable Engineering Computing (REC), February 20-22, 2008, Georgia Tech Savannah, Savannah, GA, USA.

B. Campus Contributions

Member, Graduate Committee, School of Civil and Environmental Engineering (2001 – 2002).

Established the Computational Mechanics Laboratory at GTREP (described earlier in the resume).

Developed complete electronic course notes five courses, CEE3040: Fluid Mechanics, CEE3030: Strength of Materials, CEE3050: Structural Analysis, CEE3770: Statistics & Applications, and CEE4550: Structural Analysis-II, with full animation, ready for use in distance and conventional education.

Participated in GTSAV faculty search and interview processes.

2001	8 CEE candidates and 6 ECE candidates
2002	7 CEE candidates and 6 ECE candidates
2003	7 ECE candidates

Participated in GTSAV faculty retreat, 2001.

Participated in GTSAV faculty retreat, 2002.

Participated in the ABET accreditation process of GTSAV, 2002.

Participated in the GTREP open house, 2001.

Participated in the GTREP open house, 2003.

Member, Awards Committee, School of Civil and Environmental Engineering (2006 – present).

C. Other Contributions

1980 - 1991
Senior Consultant to major architectural and structural firms

- General Company for Design and Technical Consulting–700 engineers, Damascus, Syria.
- Architecture Unit for Expertise and Consulting University of Damascus, School of Architecture, Syria.
- Millihouse Establishment–5,000 engineers, Syria.
- Department of Housing, Syria.
- Department of Education, Syria.
- Department of Defense, Syria.

Consulted on, designed and realized:

- Tishreen University health complex–14 buildings (3 high-rise buildings) of 765-bed capacity, Latakia, Syria.
- Unknown Soldier Memorial shell structure in Damascus, Syria.
- Three hotels in Bussra, Dara'a and Idleb, Syria.

- Administrative and several maintenance buildings; shell structure addition to School of Electrical and Mechanical Engineering in Damascus, Syria.
- Ten schools using The Stone Building System, Damascus providence, Syria.
- One hundred and twenty natural stone structures for houses; underground storage facilities; halls; etc., using The Stone Building System, Syria.
- Experimental realization of Low-Cost housing, International Fair of Damascus, Syria.

Analyzed and designed structures made of stone, bricks, and reinforced and prestressed concrete and steel.

Organized a whole day educational activity for the Boy Scout, Savannah, February 22, 2003, included:

- Seminar on Engineering Educations
- Visit to GTREP facilities
- Participation in distance learning class rooms

VII. Honors and Awards

The Gold Prize of the World Intellectual Property Organization (WIPO), 1988, United Nations Organization, Geneva.

The Silver Medal of the Fifth Biennale of Architecture Interarch '89, 1989, Sofia**.**

The Special Prize of the United Nations Center for Human Settlements (HABITAT), 1989.

The Aga Khan Award for Architecture, 1992.
In recognition of the new cylindrical shell structural system without steel reinforcement, flexibility in construction, and economy.
One of the most prestigious international architectural awards in the world, for recognition of architectural excellence. Awarded triennially. The award is announced in more than 150 specialized journals and approximately 400 newspapers throughout the world.

Award from the Government of Syria, 1993. For the structural analysis and design of the Unknown Soldier Memorial, Damascus.

The Architectural Personality of the Arab World, 1993, selected by magazine Al-Majala, London, U. K. The selection areas are Politics, Economics, Literature, Medicine and Art.

SAE 2005 World Congress Recognition for a substantial contribution to the technical program.