MAHTA MOGHADDAM
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Education:

- Ph.D., Electrical Engineering, 1991.
  University of Illinois at Urbana-Champaign, Urbana, IL.
  Thesis Advisor: Weng Cho Chew
  Thesis Title: Forward and Inverse Scattering Problems in the Time Domain.
- M.S., Electrical Engineering, 1989.
  University of Illinois at Urbana-Champaign, Urbana, IL
  Thesis Advisor: Weng Cho Chew
- B.S. (Highest Distinction), Electrical Engineering, 1986.
  University of Kansas, Lawrence, KS.

Work History:

- 9/2003-present: Associate Professor of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI.
- 1991-August 2003: Radar Science and Engineering Section, Jet Propulsion Laboratory, Pasadena, CA. Last position title: Senior Member Engineering Staff.
  Work Description: Development of radar-related hardware and interpretation technologies related to low-frequency sensing of subcanopy and subsurface; Development of estimation algorithms using fusion of microwave- and optical-regime data; Development of inversion algorithms for interpretation of multifrequency multipolarization and interferometric radar data; Systems Engineer, Cassini Radar; LightSAR's JPL Science Team Lead; Science Chair, JPL's "Team X." (Advanced Mission Studies team).
- 1986-1991: Research Assistant, University of Illinois at Urbana-Champaign, Urbana, IL.
  Work Description: Development of time- and frequency-domain forward and inverse scattering algorithms for sensing and detection using electromagnetic and acoustic waves.
- Spring 1989: Teaching Assistant, University of Illinois at Urbana-Champaign, Urbana, IL.
  Work Description: Instrumentation and measurement techniques laboratory instructor.
- 1985-1986: Undergraduate Research Assistant, University of Kansas Department of Electrical Engineering, Lawrence, KS.
  Work Description: Semiconductor device process simulation.
- 1984-1985: Technician, University of Kansas Department of Chemistry, Lawrence, KS.
  Work Description: High-performance liquid chromatography (HPLC).

Courses Taught at the University of Michigan:

- Fall 2003: EECS 530 – Electromagnetic Theory I, Q1= 4.03, Q2 = 4.69
- Winter 2004: EECS 330 – Electromagnetics II, Q1 = 4.36, Q2 = 4.88
- Fall 2004: EECS 530 – Electromagnetic Theory I, Q1 = 4.73, Q2 = 4.78

- Winter 2005: EECS 330 – Electromagnetics II, Q1= 4.53, Q2 = 4.74
- Fall 2005: EECS 632 – Microwave Remote Sensing II, Q1=4.00, Q2=4.17

Brief Overview of Research Contributions (not including Ph.D. work):

- *Development of multivariable radar inversion algorithms by combining electromagnetic scattering and nonlinear optimization techniques*
  - For quantitative radar image analysis and target characterization, I have developed a series of inversion algorithms that start from analytical or numerical scattering models of objects and random media, parametrize the models in terms of the fewest and most sensitive parameters describing the scattering processes, and apply nonlinear optimization techniques to simultaneously estimate these unknown parameters from multipolarization and multifrequency synthetic aperture radar data. The inversion algorithms are formulated with consideration for the stochastic nature of unknowns and data, since one of the primary purposes of these techniques is for obtaining quantitative information about vegetation and underlying ground. Several generations of the algorithm have been developed depending on the particular application and/or available data, and include those for inverting the following scene characteristics: tree height, vegetation component water content (branches, trunks), vegetation/stem density, surface soil moisture, integrated subsurface column soil moisture. This technique is, as far as I know, the only method successfully demonstrated for obtaining such specific quantitative and simultaneous information from airborne and/or spaceborne radar data.

- *Analytical and instrumentation development for noninvasive sensing of subcanopy and subsurface*
  - I have initiated a focused research effort on low-frequency radar scattering analyses and instrumentation with the aim of quantitatively (and remotely) characterizing subsurface and subcanopy properties such as soil moisture, ground layering depths, water depth (as in river and lake cross sections), and detection of subsurface interface locations. Low frequencies here refer to the VHF (100-150 MHz) and UHF (400-500 MHz) range.
  - For forward scattering analysis of vegetated surfaces, I have recently investigated and developed coherent wave interaction models within the vegetation and with the subsurface layers. For subsurface characterization, several multilayered rough surface models have been developed for (1) small roughness, and (2) general roughness. Both classes of methods are applicable to arbitrarily many layers. Inverse scattering analyses of layered media and surfaces are more complex than the single-layer models, and are currently under development in my group. The aim here is to simultaneously invert for the layered media variables, in contrast to layer stripping algorithms in which error propagation is rather quick.
  - Due to the novelty of the low-frequency methods proposed, experimental systems capable of producing relevant data did not exist beforehand. Therefore, we have developed a prototype radar instrument operated from a tower that can produce VHF and UHF data, and have successfully demonstrated its operation, data, and products. A significant contribution from this monostatic radar system has been the integration of inversion and processing algorithms, which we can refer to as a physically based processing paradigm. At low frequencies where the waves penetrate into targets, the

wave speed is not known a priori, and therefore the inverse problem needs to be solved simultaneously with radar processing. We have successfully demonstrated this approach.

- *Development of next-generation of scattering models for multilayered mixed vegetation, layered rough surfaces, including embedded collections of objects*
  - Motivated on the one hand by our low-frequency measurement system developments, where deep penetration ensues, and on the other hand by the much higher frequency developments (such as Ku- and Ka-band systems), we have been developing a number of mulilayered and/or higher-order scattering models of vegetation and subsurface. These models are at various stages of maturity and include: incoherent model for monostatic and bistatic scattering from multilayered vegetation (first and second order – second order aimed for higher-frequency applications), scattering from multilayer rough surfaces in the small perturbation regime with possible inclusion of random scatterers, scattering from multilayer rough surfaces for the general roughness scale coherent model for multilayer vegetation on multilayer soil with particular emphasis on low frequencies.
  - We are also developing efficient, practical, and accurate methods for calculating backscattering cross sections for finite discrete objects embedded anywhere within a multilayered medium with rough interfaces. The case for a circular cylindrical object has been completed, with extension to arbitrary-shaped objects an on-going effort.

- *Fusion of multisource remote sensing data*
  - Due to the complexity of scattering scenes encountered in remote sensing applications, it is often desirable to combine measurements from across the EM spectrum. In particular, we have shown that by combining microwave and optical-range frequencies – and therefore increasing the dimension of the data space – superior results in both quality and quantity are obtained when estimating parameters describing scattering scenes. Our previous work has had more emphasis on microwave regime analysis, with more qualitative approaches in the optical (visible and NIR). We plan to expand some of the radiative transfer techniques already used for radar analysis to the optical domain, and hence enable a fully quantitative modeling and inversion approach for variable estimation.

Research Awards:

- Principal Investigator, "Noncontact River Cross Section Measurement with Radar," 2005-2006. (USGS, $67K)
- Principal Investigator – "Dual-low-frequency Radar for Soil Moisture Under Vegetation Canopy and At-depth," 2002-2005. (NASA Instrument Incubator program, $4.01M)
- Principal Investigator, NASA Research Announcement – "Biomass and Wetlands Maps of the North American Boreal Region from SAR Imagery," 2001-2005. (NASA Carbon Cycle program, $496K)
- JPL Technical Lead, "Application of Remote Sensing Technology to the Alameda Corridor, Los Angeles, CA." 2001-2002. (Applications Program, $130K)
- Principal Investigator, NASA RTOP – "Fusion of Radar and Optical Remote Sensing Data: Estimating Inputs to Ecosystem Models," 1997-2000. ($350K)

- Principal Investigator, NASA RTOP – "Radar Scattering Inversion: Forested Areas," 1994-96. ($300K)
- Principal Investigator, "Assessing Fire Susceptibility and Post-Fire Vegetation Recovery." 2000-indefinite. Japanese Space Agency, NASDA. No-cost basis data.
- Co-Investigator, NIH – "The Niono Irrigation Project and Malaria: A Computer Model," 2002-2006. (NIH/UCLA, $5M)
- Co-Investigator, NASA NRA – "Synthetic Aperture Radar (SAR) On-Board Azimuth Pre-Filter Processor," 2000-2002. (NASA ATIP, $600K)
- Co-Investigator, NASA NRA – "Multi-Gigabit/sec Optical Communication Transceiver for Earth Science," 2001-2002.(NASA AIST, $700K)
- Co-Investigator, NASA RTOP – "Assimilation of SAR-Derived Parameter Maps into BIOME-BGC Process Model Over BOREAS Study Area," 1997-1999 ($300K).
- Co-Investigator, NASA AO – "Estimation of Hydrological Parameters in Boreal Forest Using SAR Data," 1993-96. ($300K)

Other Awards, Honors, and Memberships

- CRAY Research and Development Grant, 1990-1991.
- University of Kansas Honor Roll, 1983-1986.
- Senior Member, IEEE.
- Member of URSI Commission B.
- Member of Phi Kappa Phi, Tau Beta Pi, Eta Kappa Nu (Vice President, 1985-1986).
- Member of the Electromagnetics Academy.
- NASA Certificate of Achievement (two - for creative development of component and system concepts).
- NASA Group Achievement Award, Cassini Radar.

Professional Activities and External Service

- Associate Editor, IEEE Transactions of Geoscience and Remote Sensing, 2005-present
- Chapter Chair, IEEE-GRS Southeastern Michigan, 2005-present
- Reviewer for:
    - IEEE Transactions on Antennas and Propagation
    - IEEE Transactions on Geoscience and Remote Sensing
    - IEEE Geoscience and Remote Sensing Letters
    - IEEE Microwave and Wireless Components Letters
    - Radio Science
    - Remote Sensing of Environment
    - Journal of Computational Physics
    - Electronics Letters
    - Tellus
    - Journal of Electromagnetic Waves and Applications
    - Journal of the Optical Society of America
    - International Journal of Applied Earth Observation and Geoinformation
    - International Journal of Remote Sensing
    - ISPRS

- Organizer of several conference sessions
- Chair/co-Chair of several conference sessions
- Expert witness in commercial technology litigation
- NASA proposal review panel member (multiple)
- Co-Chair, NASA ESTO Radar Technology Panel, April 2003
- NPOESS Soil Moisture Working Group
- Member, NASA Surface Water Working Group
- Member, NASA ESTO Radar/Radiometer Technology Working Group
- Member of Technical Program Committee, IASTED International Conference on Antennas, Radar and Wave Propagation (ARP 2005, 2006)
- Member of Technical Program Committee, IGARSS'05
- Member of Technical Program Committee, PIERS'06

Internal Service:
- Member, U of M ASEE Panel Seminar "Running a Research Program," 3/04
- Graduate Admissions Committee, EECS U of M, 2003-2004 academic year
- Undergraduate Advisor, EE Program, 2004-2005 and 2005-2006 academic years
- EE Program Curriculum Committee, 2004-2005 and 2005-2006 academic years
- Faculty Representative, EECS Curriculum Committee, 2004-2005 academic year
- Strategic Planning Committee on Graduate Programs, 2005-2006 academic year
- Member review panel, Rackham Predoctoral Fellowship, 2006
- College Representative, AOSS faculty Candidates (5)
- College Representative, CEE faculty Candidate (1)
- Qualifying exams (multiple)
- Ph.D. committees (six, in addition to my own students)

Graduate Students:
- Pan Liang, Ph.D. 12/04.
- Alireza Tabatabaeenejad, Ph.D. expected 12/06 (passed thesis proposal exam, 09/05)
- Chih-Hao Kuo, Ph.D. expected 5/07 (passed qual exam)
- Jane Whitcomb, Ph.D., expected 12/07 (passed qual exam)
- Yuriy Goykhman, MS/Ph.D.; started 9/05
- Line van Nieuwstadt, Ph.D.; started 9/05
- Preston Partridge, MS, 5/04
- Jackie Vitaz (directed study)
- Jihun Jung (directed study)
- Nicole Campbell (directed study)

Undergraduate Students:
- Mark Haynes (EE)
- Nathaniel Osborn (EE)
- Scott Rudolph (EE)
- Song Liang (EE)
- Corey Kanitz (ME)

Student Awards:

- Alireza Tabatabaeenejad: URSI Young Scientist Award, General Assembly of the Inernational Union of Radio Science, 2005.
- Mark Haynes: Michigan Space Grant Consortium Fellowship, 2005-2006 academic year.
- Line van Nieuwstadt: NASA Harriet Jenkins Graduate Fellowship (3 years starting 2005-2006 academic year).

Journal Papers:

1. M. Moghaddam, E. Yannakakis, W. C. Chew, and C. Randall, "Modeling of the subsurface interface radar," J. Electromagn. Waves Appl.. vol. 5, no. 1, pp. 17-39, 1991.
2. M. Moghaddam, W. C. Chew, B. Anderson, E. Yannakakis, and Q. H. Liu, "Computation of transient electromagnetic waves in inhomogeneous media," Rad. Sci., vol. 26. no. 1, pp. 265-273, 1991.
3. S. M. Lee, W. C. Chew, M. Moghaddam, M. Nasir, S. L. Chuang, R. W. Herrick, and C. L. Balestra, "Modeling of rough-surface effects in an optical turning mirror using the finite-difference time-domain method," J. Lightwave Technol., vol. 9, no. 11, pp. 1471-1480, 1991.
4. M. Moghaddam, W. C. Chew, and M. Oristaglio, "Comparison of the Born iterative method and Tarantola's method for an electromagnetic time-domain inverse problem," Int. J. Imaging Syst. Tech., vol. 3, pp. 318-333, 1991.
5. M. Moghaddam and W. C. Chew, "Nonlinear two-dimensional velocity profile inversion using time-domain data," IEEE Trans. Geosci. Remote Sensing, vol. 30, no. 1, pp. 147-156, 1992.
6. M. Moghaddam and W. C. Chew, "Study of some practical issues in inversion with the Born iterative method using time-domain data," IEEE Trans. Antennas Propagat., vol. 41, no. 2, pp. 177-184, 1993.
7. M. Moghaddam and W. C. Chew, "Simultaneous inversion of compressibility and density in the acoustic inverse problem," Inverse Probl., vol. 9, pp. 715-730, 1993.
8. M. Moghaddam and W. C. Chew, "Variable-density linear acoustic inverse problem," Ultrasonic Imaging, vol. 15, pp. 255-266, 1993.
9. M. Moghaddam, S. Durden, and H. Zebker, "Radar measurement of forested areas during OTTER," Remote Sensing Environment, vol. 47, no. 2, pp. 154-166, 1994.
10. M. Moghaddam and S. Saatchi, "Analysis of scattering mechanisms in SAR imagery over boreal forest: Results from BOREAS '93," IEEE Trans. Geosci. Remote Sensing, vol. 33, no. 5, pp. 1290-1296, 1995.
11. R. Treuhaft, S. Madsen, M. Moghaddam, and J. van Zyl, "Vegetation characteristics and underlying topography from interferometric radar," Rad. Sci., vol. 31, no. 6, pp. 1449-1485, 1996.
12. W. Chew, G. Otto, W. Weedon, J.H. Lin, C.C. Lu, Y.M. Wang, and M. Moghaddam, "Nonlinear diffraction tomography: The use of inverse scattering for imaging," Int. J. Imaging Sys. Tech., vol. 7, pp. 16-24, 1996.
13. E. Njoku, Y, Rahmat-Samii, J. Sercel, W. Wilson, and M. Moghaddam, "Evaluation of an inflatable antenna concept for microwave sensing of soil moisture and ocean salinity," IEEE Trans. Geosci. Remote Sensing, vol. 37, no. 1, pp. 63-78, 1999. Featured on Cover.

14. M. Moghaddam and S. Saatchi, “Monitoring tree moisture using an estimation algorithm applied to SAR data from BOREAS,” IEEE Trans. Geosci. Remote Sensing, vol. 37, no. 2, pp. 901-916, 1999. Featured on Cover.
15. S. Saatchi and M. Moghaddam, “Estimation of crown and stem water content and biomass of Boreal forest using polarimetric SAR imagery,” IEEE Trans. Geosci. Remote Sensing, vol. 38, no. 2, pp. 697-709, March 2000.
16. M. Moghaddam, S. Saatchi, and R. Cuenca, “Estimating subcanopy soil moisture with radar,” J. Geophys. Res. - Atmospheres, vol. 105, no. D11, pp. 14899-14911, June 16, 2000.
17. Moghaddam, M., “Effect of medium symmetries on parameter estimation with polarimetric interferometry,” J. Electromag. Waves Appl., vol. 14, no. 2, pp. 173-184, 2000.
18. Lorenz RD, Elachi C, West RD, Johnson WTK, Janssen MA, Moghaddam M, Hamilton GA, Liepack O, Bunker A, Roth LE, Wall SD, Dente L, Casarano D, Posa F, “Cassini Radio Detection and Ranging (RADAR): Earth and Venus observations,” J. Geophys. Res. – Space Physics, vol. 106, no. A12, pp. 30271-30279, December 2001.
19. M. Moghaddam, J. Dungan, and S. Acker, “Forest variable estimation from fusion of SAR and multispectral optical data,” IEEE Trans. Geosci. Remote Sensing, vol. 40, no. 10, pp. 2176-2187, 2002.
20. J. Gamon, K.F. Huemmerich, D. Peddle, J. Chen, D. Fuentes, F. Hall, J. Kimball, S. Goetz, J. Gu, K. McDonald, J. Miller, M. Moghaddam, A. Rahman, J. Roujean, E. Smith, S. Walthall, P. Zarco-Tejada, B. Hu, R. Fernandes, J. Cihlar, "Remote sensing in BOREAS: Lessons learned." *Remote Sensing of Environ*, vol. 89, pp. 139-162, 2004.
21. Lucas, R., M. Moghaddam, and Natasha Cronin, “Microwave scattering from mixed species forests, Queensland, Australia,” IEEE Trans. Geosci. Remote Sensing, vol. 42, no. 10, pp. 2142-2159, 2004.
22. Liang, P., M. Moghaddam, L. Pierce, and R. Lucas, “Radar Backscattering Model for Multilayer Mixed Species Forests,” IEEE Trans. Geosci. Remote Sensing, vol. 43, no. 11, 2005.
23. Liang, P., L. Pierce, and M. Moghaddam, “Radiative Transfer Model for Microwave Bistatic Scattering from Forest Canopies,” IEEE Trans. Geosci. Remote Sensing, vol. 43, no. 11, 2005.
24. Diuk-Wasser, M., G. Dolo, MA. Bagayoko, N. Sogoba, M. B. Toure, M. Moghaddam, N. Manoukis, S. Rian, S. F. Traore, C. E. Taylot, “Patterns of irrigated rice growth and malaria vector breeding in Mali using multitemporal ERS-2 synthetic aperture radar,” Int. J. Remote Sensing, vol. 27, no.3, pp. 535-548, 2006.
25. Lucas, R., N. Cronin, M. Moghaddam, A. Lee, and C. Witte, “Integration of SAR and Landsat-derived Foliage Projected Cover for Woody Regrowth Mapping, Queensland, Australia,” Int. J. Remote Sensing, in press.
26. Lucas, R., A. Lee, N. Cronin, M. Moghaddam, C. Witte, and P. Tickle, “Empirical relationships between AIRSAR backscatter and forest biomass, Queensland, Australia,” Int. J. Remote Sensing, in press.
27. Tabatabaeenejad, A., and M. Moghaddam, “Bistatic scattering from layered rough surfaces,” IEEE Trans. Geosci. Remote Sensing, in press.
28. Kuo, C.H., and M. Moghaddam, “Scattering from Multilayer Rough Surfaces based on the Extended Boundary Condition Method and Truncated Singular Value Decomposition,” IEEE Trans. Antennas Propagat., in revision.

29. Kuo, C.H., and M. Moghaddam, "Electromagnetic Scattering From a Buried Cylinder Bounded By Two Rough Interfaces," IEEE Trans. Antennas Propagat., in revision.
30. Kuo, C.H., and M. Moghaddam, "Electromagnetic Scattering from Multilayer Rough Surfaces Separated by Stratified Media of Arbitrary Dielectric Profiles," IEEE Trans. Geosci. Remote Sensing, *in preparation.*
31. Tabatabaeenejad, A., and M. Moghaddam, "Inversion of scattering properties of a two-layered rough subsurface," IEEE Trans. Geosci. Remote Sensing, *in preparation*.
32. Moghaddam, M., E. Rodriguez, Y. Rahmat-Samii, D. Moller, J. Hoffman, L. Pierce, D. Entekhabi, and S. Wofsy, "Microwave Observatory of Subcanopy and Subsurface (MOSS): A mission concept for global deep and subcanopy soil moisture observations," IEEE Trans. Geosci. Remote Sensing, *in preparation*.
33. L. Pierce and M. Moghaddam, "The MOSS VHF/UHF radar testbed: A physics-based approach to radar processing," IEEE Trans. Geosci. Remote Sensing, *in preparation.*
34. Moghaddam, M., and A. Tabatabaeenejad, "A coherent model for VHF scattering from a forest on a multilayered rough ground," IEEE Trans. Geosci. Remote Sensing, *in preparation*.

Book Chapters:

- M. Moghaddam, W. Chew, E. Yannakakis, and C. Randall, "Modeling of the Subsurface Interface Radar," in *Review of Progress in Quantitative Nondestructive Evaluation*, vol. 10A, D. Thompson and D. Chimenti, Eds., Plenum Press, New York, 1991.
- W. Chew, W. Weedon, and M. Moghaddam, "Inverse Scattering and Imaging Using Broadband Time-domain Data," in *Ultra-Wideband Short-Pulse Electromagnetics*, L. Carin and L Felsen, Eds., Plenum Press, New York, 1995.
- R. Treuhaft, M. Moghaddam, and B. Yoder, "Forest Vertical Structure from multibaseline interferometric radar for studying growth and productivity," in *Remote Sensing: A Scientific Vision for Sustainable Development*, IEEE Press, Piscataway, NJ, 1997.

Other Publications:

- D. Evans and M. Moghaddam, Eds., "LightSAR Science Requirements Document," JPL Publication D-13945, 1998.
- M. Moghaddam, E. Rodriguez, D. Moller, and Y. Rahmat-Samii, NASA Tech Brief: "Dual low-frequency radar for soil moisture under vegetation and at-depth." (2004)
- M. Gudim (Aung), M. Moghaddam, et al., NASA Tech Brief: "Single-chip high-density FPGA implementation of the synthetic aperture radar azimuth prefilter for on-board data reduction," (2004)

Conference papers:

1. W. C. Chew and M. Moghaddam, "Resonant frequencies of the axially symmetric modes in a dielectric resonator," Proc. IEEE-MTT International Symposium," Las Vegas, Nevada, 1987.

2. M. Moghaddam and W. C. Chew, “Response of a point source in multicylindrically layered half spaces,” Joint IEEE-APS and URSI International Symposium, Syracuse, New York, 1988.
3. W. C. Chew, B. Anderson, E. Yannakakis, M. Moghaddam, and Q. H. Liu, “Computation of transient electromagnetic waves in inhomogeneous media,” Proc. URSI Int. Symp., Stockholm, Sweden, 1989.
4. M. Moghaddam, W. C. Chew, and E. Yannakakis, “Time-domain scattering in 2.5 dimensions,” Proc. IEEE-APS Int. Symp., Dallas, Texas, 1990.
5. M. Moghaddam, E. Yannakakis, and W. C. Chew, “Modeling of the subsurface interface radar,” Proc. Rev. of Prog. in Quant. Nondestruct. Eval. (QNDE), La Jolla, California, 1990.
6. M. Moghaddam and W. C. Chew, “Nonlinear two-dimensional velocity profile inversion in the time domain,” Proc. IEEE-APS Int. Symp., London, Ontario, Canada, 1991.
7. M. Moghaddam and W. C. Chew, “Stabilizing Liao's absorbing boundary conditions using single-precision arithmetic,” Proc. IEEE-APS Int. Symp., London, Ontario, Canada, 1991.
8. M. Moghaddam and W. C. Chew, “Simultaneous inversion of permittivity and conductivity profiles using time-domain data,” Proc. Int. Radio Sci. Meeting, Boulder, Colorado, 1992.
9. M. Moghaddam, S. Durden, H. Zebker, and J. Klein, “Radar measurement of forested areas during OTTER,” Proc. IGARSS '92, Houston, Texas, 1992.
10. Freeman, M. Moghaddam, M. Zink, and H. Zebker, “Radiometric correction of SAR images of varying terrain heights,” Proc. IGARSS '92, Houston, Texas, 1992.
11. M. Moghaddam and W. C. Chew, “Time-domain inverse scattering,” Proc. IGARSS '92, Houston, Texas, 1992.
12. M. Moghaddam and W. C. Chew, “Simultaneous inversion of permittivity and permeability profiles using time-domain data,” Proc. IEEE-APS Int. Symp., Chicago, Illinois, 1992.
13. M. Moghaddam and W. C. Chew, “Effect of multiple scattering in inversion using time-domain data,” Proc. IEEE-APS International Symposium, Chicago, Illinois, 1992.
14. M. Moghaddam and W. C. Chew, “Variable-density linear acoustic inverse problem,” Proc. Int. Radio Sci. Meeting, Boulder, Colorado, Jan. 1993.
15. M. Moghaddam and B. Houshmand, “Calculation of effective permittivity of a random collection of dielectric cylinders,” Proc. IEEE-APS/URSI Int. Symp., Ann Arbor, Michigan, June 1993.
16. M. Moghaddam, “A general rough-surface inversion algorithm: Theory and application to SAR data,” Proc. PIERS'93, JPL, Pasadena, California, July 1993.
17. M. Moghaddam and W. C. Chew, “Variable-Permittivity linear inverse problem for the H_z-polarized case,” Proc. PIERS'93, JPL, Pasadena, California, July 1993.
18. M. Moghaddam and A. Freeman, “Modifications to the three-component classification algorithm for SAR data,” Proc. PIERS'93, JPL, Pasadena, California, July 1993.
19. W. C. Chew, G. P. Otto, J. H. Lin, W. H. Weedon, C. C. Lu, Y. M. Wang, and M. Moghaddam, “Nonlinear inverse scattering techniques and their use in processing microwave experimental data,” Proc. PIERS'93, JPL, Pasadena, California, July 1993.
20. M. Moghaddam and S. Saatchi, “An inversion algorithm applied to SAR data to retrieve surface parameters,” Proc. IGARSS'93, Tokyo, Japan, August 1993.
21. M. Moghaddam, S. L. Durden, and H. A. Zebker, “Effects of environmental change on radar backscatter in the Oregon transect,” Proc. IGARSS'93, Tokyo, Japan, August 1993.

22. W. C. Chew, G. Otto, W. Weedon, J. Lin, C. Liu, Y. Wang, and M. Moghaddam, “Nonlinear diffraction tomography - The use of inverse scattering for imaging,” presented at the 27th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, November 1993.
23. M. Moghaddam and B. Houshmand, “An inverse scattering approach to calculation of effective permittivity of random cylindrical scatterers,” presented at the National Radio Science Meeting, Boulder, Colorado, January 1994.
24. M. Moghaddam and B. Houshmand, “Nonlinear inverse scattering applied to calculation of effective permittivity of random collections of scatterers,” Proc. IEEE-APS/URSI Int. Symp., Seattle, Washington, June 1994.
25. S. Saatchi, M. Moghaddam, K. McDonald, and S. Durden, “Comparison of microwave scattering models of vegetation,” Proc. IEEE-APS/URSI Int. Symp., Seattle, Washington, June, 1994.
26. M. Moghaddam and S. Saatchi, “Analysis of scattering mechanisms over boreal forest: Results from BOREAS'93,” Proc. IGARSS'94, Pasadena, California, August 1994.
27. M. Moghaddam, “Retrieval of forest canopy parameters for OTTER using an optimization technique,” Proc. SPIE Symposium on Satellite and Remote Sensing, Rome, Italy, September 1994.
28. S. Saatchi and M. Moghaddam, “Biomass distribution in a Boreal forest using SAR imagery,” Proc. SPIE Symposium on Satellite and Remote Sensing, Rome, Italy, September 1994.
29. R. Treuhaft, M. Moghaddam, E. Rignot, S. Saatchi, and J. van Zyl, “Extracting vegetation topographic and scattering characteristics from interferometric SAR,” presented at the National Radio Science Meeting, Boulder, Colorado, January 1995.
30. M. Moghaddam, “Using an inversion algorithm to retrieve parameters and monitor changes over forested areas from SAR data,” PIERS'95, July 1995.
31. M. Moghaddam and S. Saatchi, "Inversion of moisture content of forest canopy and floor from SAR data," PIERS'96, Innsbruck, Austria, July 1996.
32. M. Moghaddam, R. Treuhaft, S. Saatchi, and J. van Zyl, “A hybrid algorithm for estimating forest canopy parameters from polarimetric and interferometric SAR,” PIERS'97, Cambridge, MA, July 1997.
33. R. N. Treuhaft, M. Moghaddam, K. Sarabandi, and J. J. van Zyl, "Extracting Vegetation and Surface Characteristics from Multibaseline Interferometric SAR," IGARSS'96, Lincoln, Nebraska, May 1996.
34. M. Moghaddam and R. Treuhaft, “Limitations in the number of parameters estimated with polarimetric interferometry,” PIERS'98 Workshop, Baveno, Italy, July 1998.
35. M. Moghaddam, J. Dungan, and J. Coughlan, “Fusion of AIRSAR and TM data for parameter estimation and classification in dense and hilly forests,” IGARSS'99, Hamburg, Germany, June 1999.
36. M. Moghaddam, J. Dungan, and J. Coughlan, “Fusion of AIRSAR and TM data for variable estimation and classification in dense and hilly forests,” Fusion of Earth Data Conference, Sophia Antipolis, France, January 2000.
37. M. Moghaddam and R. Treuhaft, “Estimating forest vegetation variables by combining INSAR and POLSAR data and minimizing the need for ancillary data,” PIERS-2000, Cambridge, MA, USA, presented July 2000.

38. M. Moghaddam and J. Dungan, “Fusion of SAR and TM data for quantitative estimation of forest variables over an extended range of validity,” IGARSS’2000, Honolulu, HI, USA, presented July 2000.
39. R. West, M. Moghaddam, et al., “Cassini observes the Earth with Ku-band radar and radiometer,” IGARSS’2000, Honolulu, HI, USA, presented July 2000.
40. M. Moghaddam, “Estimation of comprehensive forest variable sets from multiparameter SAR data over a large area with diverse species,” IGARSS’2001, Sydney, Australia, July 2001.
41. M. Moghaddam and J. Dungan, “Estimation of forest variables from fusion of SAR and TM data and analytical scattering and reflectance models,” IGARSS’2001, Sydney, Australia, July 2001.
42. R. Lucas et al., "Use of AIRSAR data for quantifying the biomass of woodlands, Queensland, Australia," AIRSAR workshop, March 2002.
43. M. Gudim et al., “Single-chip high-density FPGA implementation of the synthetic aperture radar azimuth prefilter for on-board data reduction,” presented at Earth Science Technology Conference, Pasadena, CA, June 2002.
44. M. Moghaddam, E. Rodriguez, Y. Rahmat-Samii, and D. Moller, “Dual-low-frequency Radar for Soil Moisture Under Vegetation and At-depth,” presented at URSI General Assembly, Maastricht, The Netherlands, August 2002.
45. M. Moghaddm, K. McDonald, J. Cihlar, and W. Chan, “Mapping wetlands of Alaska and Canada from satellite radar imagery,” presented at the AGU Fall Meeting, San Francisco, CA, December 2002.
46. D. Moller, E. Rodriguez, M. Moghaddam, and J. Hoffman, “A dual-low frequency radar for subcanopy and deep soil moisture measurements,” accepted for presentation at Aerospace Conference, Big Sky, Montana, March 2003.
47. Rodriguez, E., D. Moller, and M. Moghaddam, “Synthetic aperture processor prototype for a tower-based UHF and VHF soil moisture radar,” *IGARSS’03*, Toulouse, France, July 2003.
48. Tabatabaeenejad, A., and M. Moghaddam, “Scattering of Electromagnetic Waves from three-layer Rough Surfaces Using the Small Perturbation Method,” IEEE-APS, Monterey, CA, June 2004.
49. Pierce, L., M. Moghaddam, E. Rodriguez, and P. Siqueira, “A VHF/UHF Simulator for Soil Moisture Beneath Forest Canopies,” IEEE-APS, Monterey, CA, June 2004.
50. Moghaddam, M., Chih-Hao Kuo, A. Tabatabaeinejad, and L. Pierce, “Inversion of Scattering Properties of a Multilayer Subsurface with Rough Interfaces,” IEEE-APS, Monterey, CA, June 2004.
51. Liang, P., M. Moghaddam, and L. Pierce, “Multilayer bistatic MIMICS,” IEEE-APS, Monterey, CA, June 2004.
52. Moghaddam, M., L. Pierce, A. Tabatabaeenejad, and E. Rodriguez, “Estimation of Soil Moisture at Multiple Depth Layers Using a VHF/UHF Radar,” IGARSS’04, Anchorage, AK, September 2004.
53. Liang, P., M. Moghaddam, and L. Pierce, “Radar Backscattering Model for Mixed Species Forests,” IGARSS’04, Anchorage, AK, September 2004.
54. Tabatabaeenejad, A., and M. Moghaddam, “Backscattering of Electromagnetic Waves from Layered Rough Surfaces and Its Application in Estimating Deep Soil Moisture,” IGARSS’04, Anchorage, AK, September 2004.

55. Moghaddam, M., L. Pierce, A. Tabatabaeenejad, and E. Rodriguez, “A Tower-based Prototype VHF/UHF Radar for Subsurface Sensing: System Description and Data Inversion Results,” presented at the Workshop on Radar Investigations for Planetary Applications, Lunar and Planetary Institute, Houston, Texas, February 2005.
56. Tabatabaeenejad, A., and M. Moghaddam, “Inversion of Subsurface Properties of a Layered Medium with Rough Boundaries,” IEEE-APS, Washington DC, July 2005, and URSI General Assembly, New Delhi, India, October 2005.
57. Partridge, P., et al., “Design , Fabrication, and Measurement of a Dual Polarized UHF/VHF Honeycomb Stacked-Patch Array Antenna for use in Space-borne Radar Applications,” IEEE-APS, Washington DC, July 2005.
58. Moghaddam, M., and A. Tabatabaeenejad, “Coherent Model for VHF Scattering from Mixed Forests on Multilayer Rough Ground,” IEEE-APS, Washington DC, July 2005, and IGARSS’05, Seoul, Korea, July 2005.
59. Kuo, C.H., and M. Moghaddam, “Scattering from Multilayer Rough Surfaces Based on Extended Boundary Condition Method and Scattering Matrix Approach,” IEEE-APS, Washington DC, July 2005, and IGARSS’05, Seoul, Korea, July 2005.
60. Pierce, L., and M. Moghaddam, “The MOSS VHF/UHF Spaceborne SAR System Testbed,” IGARSS’05, Seoul, Korea, July 2005.
61. Whitcomb, J., M. Moghaddam, J. Kellndorfer, and K. McDonald, “Use of JERS Satellite Imagery for Boreal Wetlands Mapping,” presented at AGU Fall Meeting, December 2005.
62. Kuo, C.H., and M. Moghaddam, “Backscattering Enhancement of Surface Plasmons from Multilayer Rough Surfaces,” presented at URSI National Meeting, Boulder, CO, January 2006.

Invited Presentations at Conferences

63. M. Moghaddam, “NASA/JPL AIRSAR: System overview and introduction to data interpretation,” presented at the Australasian Remote Sensing Conference, Melbourne, Australia, March 1994.
64. W. Chew, W. Weedon, and M. Moghaddam, “Inverse scattering and imaging using broad-band time-domain data,” Int. Conf. on Ultrawideband, short-pulse Electromagnetics, Brooklyn, NY, April 1994.
65. R. N. Treuhaft, E. Rodriguez, M. Moghaddam, K. Sarabandi, and J. J. van Zyl, "Multibaseline, Multifrequency Interferometric SAR for Vegetation and Surface Topographic Parameter Estimation," URSI 25th General Assembly, Lille, France, August 1996.
66. M. Moghaddam, S. Saatchi, and R. Treuhaft, “Estimating soil moisture in a boreal old jack pine forest,” IGARSS'97, Singapore, August 1997.
67. Treuhaft, M. Moghaddam, and J. van Zyl, “Combining radar interferometry and polarimetry to estimate forest vegetation and surface parameters,” PIERS’97, Cambridge, MA, July 1997.
68. R. N. Treuhaft, M. Moghaddam, and B. J. Yoder, “Forest Vertical Structure from Multibaseline Interferometric Radar for Studying Growth and Productivity” IGARSS’97, Singapore, August 1997.
69. M. Moghaddam and R. Treuhaft, “A hybrid algorithm for estimating forest parameters from POLSAR and INSAR data: an approach to minimizing the need for ancillary data,” PIERS'98, Nantes, France, July 1998.

70. Saatchi and M. Moghaddam, “Estimation of boreal forest biomass using multichannel SAR imagery,” PIERS’97, Cambridge, MA, July 1997.
71. R. Treuhaft and M. Moghaddam, “A unified analysis of radar interferometry and polarimetry for the estimation of forest parameters,” PIERS'98, Nantes, France, July 1998.
72. M. Moghaddam, “Effect of medium symmetries in limiting the number of parameters estimated with polarimetric interferometry,” IGARSS'99, Hamburg, Germany, June 1999.
73. M. Moghaddam, S. Saatchi, and R. Cuenca, “Estimating subcanopy soil moisture with AIRSAR data,” Annual AIRSAR Workshop,” Pasadena, CA, USA, February 1999.
74. J. Dungan and M. Moghaddam, “Statistical characteristics of optical and radar data used for estimating continuous vegetation variables,” PIERS-2000, Cambridge, MA, USA, presented July 2000.
75. M. Moghaddam and S. Saatchi, “Estimation of vegetation variables using AIRSAR data containing multiple scattering mechanisms,” PIERS-2000, Cambridge, MA, USA, and IGARSS’2000, both presented July 2000.
76. M. Moghaddam, “Sensitivity of Vegetation Biomass Estimation Accuracy to SAR Parameter-Diversity using an Analytically Based Algorithm,” presented at PIERS’02, Cambridge, MA, July 2002.
77. Huang, J., Y. Rahmat-Samii, and M. Moghaddam, “A VHF/UHF dual-band dual-polarized microstrip array,” presented at PIERS’2003.
78. Moghaddam et al., “Microwave Observatory of Subcanopy and Subsurface (MOSS): A Low-frequency Radar for Global Deep Soil Moisture Measurements,” IGARSS’03, Toulouse, France, July 2003.
79. Moghaddam et al., “Microwave Observatory of Subcanopy and Subsurface (MOSS) IIP: Final Results and Next Steps,” ESTC-2005, Washington DC, June 2005.
80. Moghaddam, M., Y. Rahmat-Samii, E. Njoku, E. Rodriguez, and D. Entekhabi” “A Combined Radar and Radiometer Concept for a Next-Generation Surface-to-Depth Soil Moisture Mission,” PIERS’05, August 2005.
81. Moghaddam, M., et al., “Microwave Observatory of Subcanopy and Subsurface (MOSS): A Mission for Global Observations of Deep Soil Moisture,” presented at AGU Fall Meeting, San Francisco, CA, December 2005.

Other Invited Presentations:

- Invited talk presented at the AOSS department: “Microwave Observatory of Subcanopy and Subsurface (MOSS): A Low-frequency Radar for Global Deep Soil Moisture and Structure Measurements,” April 2004.
- Invited talk presented at the University of Illinois, Urbana-Champaign: “Inversion of Scattering Properties of a Multilayer Subsurface with Rough Interfaces,” October 2004.
- Invited talk presented at the Integrated Program Office, Washington, DC, for the NPOESS Soil Moisture Working Group: “Prototype Tower Based Multifrequency and Polarimetric Radar for Subcanopy and Deep Soil Moisture,” September 2005.
- Invited seminar, Harvard University, Atmospheric Sciences: “Potential for measuring deep and undercanopy soil moisture: a tower-based radar prototype system and measurement results,” October 2005.
- Invited talk to be presented at the Applied Physics Program Weekly Seminars, November 2005.