

Essam A. Marouf
Professional Summary

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Personal Information

Born July 19, 1944.
Married; two children.
Naturalized U.S. Citizen.

Education

Ph.D. in Electrical Engineering (Major) and Computer Science (Minor),
Stanford University, Stanford, California, 1975.
Dissertation: The Rings of Saturn: Analysis of a Bistatic-Radar Experiment.

B.S. and M.S. in Electrical Engineering (Communications),
University of Alexandria, Egypt, 1965 and 1968, respectively.

Areas of Expertise

Digital and statistical signal processing; spectral estimation; signal reconstruction and restoration; electromagnetic wave propagation and scattering; waves in random media; Fourier and statistical optics; inverse scattering; application to planetary exploration using unmanned spacecraft.

Professional Positions

1990- : Professor of Electrical Engineering, College of Engineering, San Jose State University, San Jose, CA.
2005-2006: Visiting Professor, Department of Electrical Engineering, Stanford University, CA (on sabbatical leave from San Jose State University).
1998-1999: Senior Visiting Scientist, NASA Jet Propulsion Laboratory, California Institute of Technology, CA (on sabbatical leave from San Jose State University)
1981-1990: Senior Research Scientist, Space Telecommunications and Radio Science (STAR) Lab, Department of Electrical Engineering, Stanford University, CA.
1978-1981: Research Associate, STAR Lab, Department of Electrical Engineering, Stanford University, CA.
1975-1978: Assistant Professor of Electrical Engineering, University of Alexandria, Egypt.
1970-1975: Graduate Research Assistant, STAR Lab, Department of Electrical Engineering, Stanford University, CA.

Professional Involvement

Principal Investigator and Team Member, the International Cassini-Huygens Mission to the Saturn System, Cassini Radio Science Team (1990-present)
Co-Investigator and Team Member, the Rosetta Mission to a Comet, Rosetta Radio Science Investigation Team (1996-present)
Associate Team Member, the Voyager Mission to Jupiter, Saturn, Uranus, and Neptune, Voyager Radio Science Team (1979-1989)
Principal Investigator, NASA Planetary Geology and Geophysics (PG&G) Program (1992-1999)
Member of the NASA Outer Planets Science Working Group, a NASA Headquarters Advisory Board (1993-1995)
Member of the Science Working Groups for the Cassini Mission to Saturn (1991-present)
Member of the Science Working Groups for the Voyager Jupiter, Saturn, Uranus, and Neptune encounters (1979-1989)
Investigator on many completed research projects (1980-present).

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Academic Activities

Chair and Member of the San Jose State University, Charles W. Davidson College of Engineering Dean Search Committee (Fall 2012).

Chair and Member of the San Jose State University, Charles W. Davidson College of Engineering Research Committee (2010-2012).

Served on the SJSU President's Scholar Award Selection Committee, 2007-08 and 2008-09, 2010-2011, 2011-12.

Served on the SJSU Wang Family Excellence Award Committee 2007.

Member of the College of Engineering Retention, Tenure, and Promotion (RTP) Committee, San Jose State University (2003-2005).

Chair and Member of the San Jose State University Graduate Studies and Research Committee (1993-1995).

Member of the College of Engineering Graduate Studies and Research Committee, San Jose State University (1990-1993).

Research Advisor of many completed M.S. Projects and Theses, Department of Electrical Engineering, College of Engineering, San Jose State University (1990-present).

Research Activities

For over 35 years, I have been actively involved in research related to planetary exploration by unmanned spacecraft using Radio Science techniques. My research attempts to bring radio wave scattering and signal processing techniques to bear on characterization and understanding of the structure and physical properties of planetary rings, atmospheres, and surfaces. Research efforts over the past nearly 20 years have been devoted primarily to the planning, design, implementation, data analysis, and scientific interpretation of a set of Cassini experiments to study Saturn, its remarkable ring system, and its enigmatic planet-size satellite Titan. As a Cassini Radio Science Team Member, I play a leading role in all aspects of the efforts above. Rich Cassini Radio Science data sets have been already acquired, revealing a wealth of new information about the Saturn system.

The Cassini research efforts (1991-present) build on another nearly 15 years of research experience related to analysis of similar observations collected from Radio Science experiments completed during two Voyager spacecraft grand-tour of the outer solar system: Jupiter (1979), Saturn (1981), Uranus (1986), Neptune (1989), and their satellites Titan (1981) and Triton (1989).

Other Research Activities: Guidance of graduate student research addressing topics that include: inverse scattering using Bayesian techniques, time-frequency analysis of nonstationary signals, turbo-coding in digital communications, adaptive multipath equalization in GPS and mobile communication receivers, implementation of digital phase locked loops using DSP processors, subband and wavelets image coding, image watermarking, adaptive interference cancellation, among others.

Publications

Author or co-author of over 100 papers published in refereed journals, review books, and conference bulletins/proceedings. Recent ones related to ongoing research efforts include:

- Particle Size Distribution in Saturn's Ring C (2012), E. A. Marouf *et al.*, 44th DPS Meeting, Reno, Nevada.
- The structure of Titan's atmosphere from Cassini radio occultations: Occultations from the Prime and Equinox missions (2012), P. J. Schinder, F. M. Flasar, E. A. Marouf, *et al.*,

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Icarus **221**, 1020-1031.

- The structure of Titan's atmosphere from Cassini radio occultations (2011), P. J. Schinder, F. M. Flasar, E. A. Marouf, *et al.*, *Icarus* **215**, 460-474.
- Saturn's equatorial oscillation: Evidence of descending thermal structure from Cassini radio occultations 2011), P. J. Schinder, F. M. Flasar, E. A. Marouf, *et al.*, *Geophysical Research Letters* **38**, 8, L047191.
- Uncovering of Small-Scale Quasi-Periodic Structure in Saturn's Ring C and Possible Origin – Invited (2011), E. Marouf *et al.*, European Planetary Science Congress (EPSC) and the American Astronomical Society's Division of Planetary Sciences (DPS) Joint Meeting, Nantes, France, October 02-07.
- The discontinuous core of Saturn's F-Ring and orbit model (2010), E. Marouf *et al.*, the American Astronomical Society's Division of Planetary Sciences (DPS) 42nd Meeting, Pasadena, CA, October 03-08.
- Occultation observations of Saturn's B ring and Cassini Division (2010), R. G. French, E.A. Marouf, *et al.* (2010), *Astronomical Journal* **139**, 1649-1667.
- Titan's Atmospheric Extinction Profiles from Cassini Radio Occultations, (2010), Marouf *et al.*, European Planetary Science Congress (EPSC), Rome, Italy, September 19-24.
- Diffraction theory modeling of near-forward radio wave scattering from particle clusters (2009), F. S. Thomson and E. A. Marouf, *Icarus* **204**, 290-302.
- Mid-latitude and high- latitude electron density profiles in the ionosphere of Saturn obtained by Cassini radio occultation observations (2009), Kliore, A. J., A. F. Nagy, E. A. Marouf *et al.*, *J. Geophys. Res.*, **114**, A04315, doi:10.1029/2008JA013900
- Physical properties of Saturn's rings from Cassini radio occultations (2008), E. A. Marouf *et al.*, 40th Meeting of the American Astronomical Society, Division for Planetary Sciences, Cornell University, Ithaca, N.Y., 10-15 October.
- Dielectric constant of Titan's South polar region from Cassini Radio Science bistatic scattering observations (2008), E. A. Marouf *et al.*, Fall 2008 AGU Meeting, P21A-1319, San Francisco, CA, 15-19 December.
- First results from the Cassini radio occultations of the Titan ionosphere (2008), Kliore, A. J., A. F. Nagy, E. A. Marouf *et al.*, *J. Geophys. Res.*, **113**, A09317, doi:10.1029/2007JA012965.

Teaching Activities

San Jose State University (1990-): Graduate:

- Lead teaching graduate courses in the area of Digital Signal Processing, primarily the two course sequence EE253 (fundamentals of time/frequency analysis and digital filtering) and EE254 (filter-banks and wavelets, optimal filtering, linear predictive coding, classical and modern spectral estimation, and adaptive signal processing). The sequence offers a comprehensive foundation for graduate students interested in working or doing research in this core area. The material covered graduates from the fundamentals to state-of-the-art research topics. All topics covered are supported by computational examples (based on Matlab) that provide hands-on experience with algorithm development. I wrote a set of lecture notes for this course sequence. Average SOTE scores for EE253 and EE254 are 4.6 and 4.7 (the SJSU SOTE scores span the range 0.0 to 5.0; top score is 5.0).
- Developed and taught a new course on Computed Imaging – EE296D/EE264 (basic image processing techniques and related applications in Fourier optics, ultrasonic medical imaging, computed tomography, synthetic-aperture radar, and planetary exploration). I wrote a set of lecture notes for this course. Average SOTE scores for EE264 and EE296D are 4.7 and 4.8, respectively.

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- Developed and taught a new course on Digital Communications Processing – EE296M (digital signal processing algorithms for analysis and simulation of basic digital communication functions, including digital modulation, optimal receivers, carrier and symbol synchronization, channel equalization and adaptive implementations). Average SOTE score for 296M is 4.5. Another course I taught in this general area is Digital Data Transmission I – EE251. Average SOTE score is 4.7.
- Restructured and taught a graduate core course on Linear Systems Theory. I wrote a set of lecture notes for this course. Average SOTE score for EE210 is 4.8

Undergraduate:

- Taught a broad spectrum of courses including Computational Methods in Electrical Engineering – EE104 (average SOTE score 4.8), Signals and Systems – EE112 (4.3), Principles of Electromagnetic Fields – EE140 (4.4), Electromagnetic Waves – EE142 (4.1), and Digital Communications – EE160 (4.4), Network Analysis – EE110 (3.9). Led the EE Department curriculum update of EE110 (now a course on Circuits and Systems) and EE12 (now an Introduction to Signal Processing).

Stanford University (1970-1975; 1978-1990):

Graduate:

- Taught courses on the Fourier Transform and its Applications, Digital Signal Processing, and Statistical Signal Processing.
- Updated and taught a course on Electromagnetic Scattering Theory and Applications, emphasizing both computational and analytical techniques.
- Taught Waves I (common mathematical and physical aspects of acoustic, electromagnetic, and elastic waves), and Waves II (intermediate electromagnetic waves and applications).

Undergraduate:

- Taught Digital and Analog Electronic Design Laboratories.

Honors and Awards

- SJSU College of Engineering McCoy Family Faculty Award for Excellence in Service, 2013.
- SJSU College of Engineering Newnan Brothers Award for Faculty Excellence, 2012
- SJSU President's Scholar Award, Academic Year 2006-2007.
- SJSU College of Engineering Excellence in Scholarship Award, 2001.
- Cassini Group Achievement Award to Cassini Solstice Pre-Integration Team, 2011
- Cassini Group Achievement Award to Cassini Radio Science Team, 2010
- Cassini Group Achievement Award to Cassini Rings Target Working Group, 2009
- Cassini Group Achievement Award to Cassini Saturn Target Working Group, 2009
- Cassini Group Achievement Award to Cassini Titan Orbiter Science Team, 2009
- Cassini Group Achievement Award to Cassini Magnetosphere Target Working Group, 2009
- NASA Group Achievement Award for Saturn (1981), Uranus (1986), and Neptune (1989) encounters.
- NASA Certificate of Appreciation Award for "exceptional scientific and engineering design of the Voyager 1 Saturn's ring occultation and scattering experiments," 1981