Alejandra V. Mercado, Ph.D.

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WORK EXPERIENCE

2022-present	Osorno Technologies; CEO and engineer
2012-present	University of Maryland at College Park, Associate Director for Curriculum for the Masters in Telecommunications Program, Electrical and Computer Engineering Department
2011	Montgomery College, Germantown Campus; Engineering Faculty.
2007-11	Hughes Network Systems; Principal Engineer in the Advanced Development Group.
2006	Rensselaer Polytechnic Institute; Adjunct Professor at the Department of Electrical, Computer and Systems Engineering.
2001-06	Rensselaer Polytechnic Institute; Assistant Professor at the Department of Electrical, Computer and Systems Engineering.

EDUCATION

Ph.D. Electrical Engineering	University of Maryland, College Park. — Ph.D. Dissertation: "Adaptive Service Rate for Integrated Multimedia over Wireless Networks." Major area of specialization: Communications, minor area of specialization: Controls.
Master of Sc. Electrical Eng.	University of Maryland at College Park. — M.S. Scholarly Paper: "Wireless Communications: Cost Optimization for Mobile Paging Using a Tracking Technique." Specialized in the area of Communications.
B.S. Mathematics	University of Maryland at College Park.
B.S. Electrical Engineering	University of Maryland at College Park.

ACADEMIC WORK

Courses Taught

Elements of Discrete Signal Analysis (ENEE 222 at UMCP)

Special Topics in Computing: Foundations of Machine Learning (ENTS669D at UMCP),
Principles of Machine Learning (MSML 603/DATA 603 at UMCP),

Advanced Topics in Wireless Communications: Wireless OFDM Systems (ENTS 759B at UMCP),

Intelligent Wireless Technologies: Communications principles for adaptive intelligent systems (ENTS659M at UMCP),
Signal and System Theory (ENEE 322 at UMCP),

Digital Communications (ENTS 622 at UMCP),

Short Range Wireless Systems (ENTS 689W at UMCP),

Introduction to Programming Concepts for Engineers (EE140 at MC),
Intermediate Programming Concepts for Engineers (EE150 at MC), Introduction
to Engineering Concepts (ES100 at MC),

Physics I for non-engineers(PH203 at MC), Digital Logic Design (EE244 at MC),
Communications Systems (ECSE 4520 at RPI),

Estimation and Detection Theory (ECSE 6520 at RPI),

Digital Communications (ECSE 6560 at RPI), Wireless Communications (ECSE 6961 at RPI),
Fundamentals of Circuit Theory for Non-Electrical Engineering Majors (UMCP),

Digital Signal Processing (EE425 at UMCP).

Course and Laboratory Creation and Development

UMCP, 6G and AI in Communications, ENTS659N

UMCP, Software Defined Radio Lab for Digital Communications, ENTS622, testing PA non-linearity, analog and digital modulation, equalization, and synchronization.

UMCP, Software Defined Radio Lab for OFDM Systems, ENTS759B, implementing an OFDM system on Ettus B210 USRP.

UMCP, ENTS 659M Intelligent Wireless Technologies: Communications principles for adaptive intelligent systems. This course covers the physical layer communications components of Machine-to- Machine (M2M) technologies, Intelligent Transportation Systems (ITS), and Smart Grid Systems.

UMCP, ENTS 699L LTE Network Protocols Testing Equipment Lab: Students learn to perform device-to-device mobile testing, using the Spirent Wireless Test Station, WTS 122. Student learn to use Spirent's Elevate Test Framework, which allows the performance evaluation for IMS, VoLTE and RCS protocol messaging and signaling. Students also learn to use the ProLab Testing Suite, which enables the student to perform basic and automation tests, and verify proper protocol implementation in equipment; it is designed to simulate concurrent voice and video calls in IP, IMS/VoLTE and 3G-324M network environments.

UMCP ENTS699R, Analytical Foundations of Telecommunications: provide the fundamental knowledge and analytical tools necessary to pursue graduate-level studies in telecommunications.

UMCP ENTS699D, Mathematical Analysis for Telecommunications: provide the fundamental mathematical skills necessary to initiate graduate-level studies in telecommunications.

UMCP, ENTS 689W Short Range Wireless Systems: covers the physical layer characteristics and performance of wireless LAN technologies including ZigBee (IEEE 802.15.4), prominent 802.11 standards, and Bluetooth. The course focuses on the modeling and implementation of physical layer aspects of these technologies, such as channel characteristics, modulation techniques and packet and frame synchronization, carrier recovery and symbol synchronization, ranges and data rates.

RPI, ECSE 6961 Wireless Communications: A comprehensive description of the concepts used in modern wireless and cellular systems. The general topics covered are wireless channel models, multi-access issues, such as FDMA/TDMA and CDMA with a brief view of GSM, descriptions of digital transmission methods in wireless, receiver diversity, channel estimation and multiuser detection, and wideband communications.

Service

General Academic Affairs Committee, ECE Department, at UMCP

UMB-UMD MS in Health Computing Committee, ECE Department, at UMCP

Strategic Plan Academic Excellence Subcommittee, Office of the Provost at UMCP
Engineering Diversity Committee Chair for Clark School of Engineering at UMCP Advising
graduate students for the Masters in Telecommunications Program at UMCP Engineering
Freshmen Review Committee for Clark School of Engineering at UMCP Graduate Committee
Member for the ECSE Dept. at RPI

Undergraduate Adviser for 66 Undergraduate students at RPI

Career Speaker at the 16th annual Sonya Kovalevsky Day at MC

Research Areas

- ML prediction methods for applications in PHY layer

- Indoor positioning systems and sensor fusion

- Joint Network Coding and Cooperative Diversity for wireless networks.

- New technique for generating secret keys for secure wireless communications which uses the random characteristics inherent to the physical channel's deep fades. It is virtually impossible for any observer which is not exactly located at the receiver's position to know or predict the exact envelope of the receiver. *Even in the presence of interference* the similarity between envelopes of the transmitter and receiver is enough to obtain equal secret keys for both desired nodes.

- Created a physical layer cooperative diversity technique for ad-hoc wireless networks that permit the nodes for such networks to be as simple, small, flexible, long-lasting, and affordable as possible. Distributed transmit and receive diversity was used, aided by RAKE receivers to introduce a very simple synchronization technique, to enhance the overall SNR of the received signal and, more importantly, reduce power expenditure.

- Smart reconfigurable plasma antennae (TM Haleakala Research and Development Inc.), which carry the benefits of single lobe capability, multilobe capability, omnidirectionality, and 360 degree steerability – all with a single element surrounded by a plasma blanket - for cooperative diversity to reduce interference.

- UWC: time-reversal as a method to reduce the delay spread of the received signal to increase channel diversity. Preliminary studies on the properties of a UWB channel were examined to better understand the feasibility and challenges of applying TR to UWB multi-input multi-output (MIMO) systems.

Publications

- B. Azimi-Sadjadi, A. Kiayias, A. Mercado, B. Yener, "Robust Key Generation from Signal Envelopes in Wireless Networks", *accepted for ACM Conference on Computer and Communications Security,* Oct.-Nov. 2007, Alexandria, Va

- A. Bahei-Eldin, B. Azimi-Sadjadi, A. Mercado, "Analysis of Ultrawideband Channels for Use with Time-Reversal", i*nvited paper for DCDIS 4th International Conference on Engineering Applications and Computational Algorithms,* July 2005, Guelph, Ontario, Canada

- H. Shen, B. Azimi-Sadjadi, A. Mercado, "Cluster Recruiting for Ad Hoc Cooperative Networks", *invited paper for DCDIS 4th International Conference on Engineering Applications and Computational Algorithms,* July 2005, Guelph, Ontario, Canada

- A. Mercado and B. Azimi-Sadjadi, "Diversity Gain for Cooperating Nodes in Multi-Hop Wireless Networks" , IEEE Vehicular Technology Conference, Los Angeles, CA September 2004

- A. Mercado and B. Azimi-Sadjadi, "Power Efficient Link for Multi-Hop Wireless Networks", *Allerton Conference*, July, 2003.

 - A. Mercado and K.J.R. Liu, "Adaptive QoS for Wireless Multimedia Networks Using Power Control and Smart Antennas", *IEEE Transactions on Vehicular Technology*, volume 51, issue 5, pp. 1223-1233, Sept. 2002.

- Alejandra Mercado and K.J. Ray Liu, *NP-Hardness of the Stable Matrix in Unit Interval Family Problem in Discrete Time,* Systems and Control Letters, volume 42, issue 4, pp. 261-265, April 2001

- A. Mercado and K.J.R. Liu, "Rate Control for DS-CDMA Wireless Systems Using Power Control and Orthogonally Coded Substreams, *Proc. IEEE ICC*, Volume 1, pp. 548-552, New York, May 2002.

- A. Mercado and K.J.R. Liu, "Rate Control for DS-CDMA Channels Using Power Control and Short Orthogonal Pseudo Random Codes", *Proc. IEEE Vehicular Technology Conference,* Volume 3, pp. 1716-1720, Atlantic City, October 2001.

- A. Mercado and K.J.R. Liu, "Adaptive QoS for Mobile Multimedia Applications with Power Control and Smart Antennas", *Proc. IEEE International Conference on Communications*, Volume 1, pp. 60-64, New Orleans, June 2000.

 - A. Mercado and K.J.R. Liu, "Adaptive QoS for Mobile Multimedia Services over Wireless Networks," *Proc. IEEE International Conference on Multimedia and Expo*, Volume 1, pp. 517-520, New York, July-August 2000.

Chapter in Book

Securing Wireless Communications at the Physical Layer, Chapter "Secret Communication over Fading Channels", joint authorship with B. Azimi-Sadjadi, A. Kiayias, and B. Yener.

Patent

Systems and Methods for Key Generation in Wireless Communication: Joint RPI/University of Connecticut Patent

Case filed with the U.S. Patent and Trademark Office on October 15, 2008, and assigned Serial No. 12/288,023.

Panel and Committee Member

- NSF Signal Communication Panel (2004)
- NSF S-STEM (2006): Scholar Science, Technology Engineering and Mathematics
- NSF CAREER/COMM Panel (2004): Directorate for Computer & Information Science and Engineering (CISE), Division of Computing & Communication Foundations (CCF)
- Doctoral Committee Member on four occasions

Research Proposal Approved and Funded

"Smart Reconfigurable Plasma Antennas for Seamless Sensor Network Communications" in collaboration with Dr. Ted Anderson, Prof. Igor Alexiff, and Prof. Shivkumar Kalyanaraman. U.S. Air Force STTR *Seamless Sensor Network Communications* STTR AF04-T015

Professional and Public Lectures

- A.J. Clark School of Engineering, UMCP, "School of Engineering Implementing the Diversity Plan"
- Masters in Telecommunications Program, UMCP, "ENTS Scholarly Paper" seminar
- Masters in Telecommunications Program, UMCP, "Women in Engineering" seminar
- Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile: "Opportunities for collaboration in research and academia between UCV and RPI."
- Facultad de Ciencias Físicas y Matemáticas de la Universidad de Chile, Santiago, Chile: "Adaptive Service Rate over Wireless Networks Using CDMA Subcoding"
- Polytechnic University, Brooklyn: "Quality of Service Control for Integrated Multimedia Services over Wireless Networks" (may be seen at http://www.poly.edu/Podium/ees2001.php)
- University of Pittsburg, Pensylvania: "Adaptive QOS for Multimedia Services over Wireless Networks"
- University of Maryland, Baltimore Campus: "Adaptive Rate Control over CDMA Wireless Networks"

Reviewing

IEEE Trans. Wireless Communications, IEEE Trans. Vehicular Technology, IEEE Communications Letters, IEEE Trans. on Multimedia, Special Issue on Multimedia over IP '2001, Journal of Wireless Communications and Mobilr Computing, Special Issue Advances in Resource-Constrained Device Networking

Prentice Hall: "Detection and Estimation Theory and Its Applications" by Thomas Schonhoff and Arthur Giordano

IEEE ICC, IEEE VTC, IEEE International Symposium on Circuits and Systems, IEEE International Conference on Multimedia and Expo

AWARDS

2012	Masters in Telecommunications Instructor Award, University of Maryland at College Park
2009	Hughes Engineering Excellence Award for Significant Contributions to Advanced Technology Development.
1997	Maryland Diversity Grant. The fellowship covered the academic year 1997-1998.
1997	George Corcoran Award
1993	Senatorial Scholarship, Maryland State Scholarship Board
1987	Senatorial Scholarship, Maryland State Scholarship Board
1985	Selected by the University of Chile from among highest ranking students in the Physics part of the University Entrance Examination of Chile