

PROMOTION RECOMMENDATION

University of Michigan
College of Engineering

Amir Mortazawi, associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees

B.S. 1987 State University of Stony Brook, Electrical Engineering
M.S. 1988 University of Texas at Austin, Electrical Engineering
Ph.D. 1990 University of Texas at Austin, Electrical Engineering

Professional record

2001-present Associate Professor of Electrical Engineering and Computer Science, University of Michigan
1998-2001 Associate Professor of Electrical and Computer Engineering, North Carolina State University
1995-1998 Associate Professor of Electrical and Computer Engineering, University of Central Florida
1990-1995 Assistant Professor of Electrical and Computer Engineering, University of Central Florida
1987-1990 Research Assistant, The University of Texas at Austin
1987-1988 Teaching Assistant, The University of Texas at Austin
1987 Engineer, AT&T Bell Laboratories

Summary of Evaluation:

Teaching: Professor Mortazawi is an outstanding contributor to the academic mission of the EECS Department. He has made considerable contributions to three aspects of teaching while at Michigan, namely, 1) formal classroom teaching of both undergraduate and graduate courses, 2) development and enhancement of graduate and undergraduate courses and laboratories, 3) mentoring of graduate students and to a lesser extent undergraduate students. While only four years at Michigan, he has taught five different courses, one at the junior level, two at the senior level, and two at the graduate level. The development of two entirely new courses, viz. EECS 498 (RF Engineering) and EECS 598 (Radio Frequency Power Amplifier Design), together with his effort to overhaul EECS 411 (Microwave Engineering), an undergraduate major design course, are considered his principal teaching contributions. Modifications in EECS 411 are aimed at introducing a "design experience" into the curriculum to address ABET requirements. He also significantly improved EECS 525 (Advanced Solid State Microwave Circuits course). His average Q1, Q2, and class enrolment are 4.0, 3.9, and 30, respectively; near EECS averages.

Research: Since joining the University of Michigan in 2001, Professor Mortazawi has made groundbreaking contributions in three significant areas. (i) He is considered an important leader in the development of novel power combining architectures; his demonstration of a dual stage 25 Watt Ka-band power combining amplifier is widely regarded as a milestone in the field (2002). Recently, he extended this work by developing computational tools for analyzing and optimizing field coupling from power-combining arrays into hard horns; this development now paves the way for the efficient deployment of antenna-integrated power-combining arrays in highly directional communication links. (ii) He is the originator of a new class of power amplifiers which, compared to their predecessors, are highly compact,

immune to losses, and far more amenable to on-wafer integration (2004). The operation of these amplifiers is based on so-called extended resonance principles, also invented by Professor Mortazawi, and recently used by him (and others) to develop novel circuits carrying out dual power dividing and phase shifting functions. (iii) Finally, he developed highly original and practical techniques for characterizing thin ferroelectric films, which he then used to construct tunable resonators for eliminating amplifier distortions and nonlinearities (2003). Professor Mortazawi's research success looks to continue for years to come.

Recent and Significant Publications:

- J. Choi and A. Mortazawi, "Design of Push-Push and Triple-Push Oscillators for Reducing $1/f$ Noise Upconversion," To appear in *IEEE Transactions on Microwave Theory and Technique*, Dec. 2005
- L. Schulwitz and A. Mortazawi, "A Compact Dual Polarized Multibeam Phased Array Architecture for Millimeter-Wave Radar," To appear in *IEEE Transactions on Microwave Theory and Technique*, Dec. 2005
- M. Ozkar and A. Mortazawi, "Electromagnetic modeling and optimization of spatial power combiners/dividers with hard horns", under revision, *IEEE Transactions on Antennas and Propagation*, Volume: 53, Issue: 1, Pages: 144 - 150, Jan 2005
- Jonghoon Choi and Amir Mortazawi, "Free-space power combining oscillator array for Solar power transmission," *The Radio Science Bulletin, International Union of Radio Science, URSI*, NO. 311, Pages 47 - 54, Dec 2004
- A. Tombak and A. Mortazawi, "A Novel Low-Cost Beam-Steering Technique Based on the Extended-Resonance Power-Dividing Method," *IEEE Transactions on Microwave Theory and Techniques*, Volume: 52, Issue: 2, Pages: 664 - 670, Feb. 2004
- X. Jiang, S. Ortiz and A. Mortazawi, "A Ka-Band Power Amplifier Based on the Traveling-Wave Power-Dividing/Combining Slotted-Waveguide Circuit" *IEEE Transactions on Microwave Theory and Techniques*, Volume: 52, Issue: 2, Pages: 633 - 639, Feb. 2004
- J. Xin; L. Li; S.C. Ortiz; R. Bashirullah; A. Mortazawi; "A Ka-band power amplifier based on a low-profile slotted-waveguide power-combining/dividing circuit", *IEEE Transactions on Microwave Theory and Techniques*, Volume: 51, Issue: 1, Pages: 144 - 147, Jan. 2003
- Tombak, A.; Maria, J.-P.; Ayguavives, F.T.; Zhang Jin; Stauf, G.T.; Kingon, A.I.; Mortazawi, A., "Voltage-controlled RF filters employing thin-film barium-strontium-titanate tunable capacitors", *IEEE Transactions on Microwave Theory and Techniques*, Volume: 51, Issue: 2, Pages: 462 - 467, Feb 2003
- Batty, W.; Christoffersen, C.E.; Yakovlev, A.B.; Whitaker, J.F.; Mortazawi, A.; Al-Zayed, A.; Ozkar, M.; Ortiz, S.C.; Reano, R.M.; Yang, K.; Katehi, L.P.B.; Snowden, C.M.; Steer, M.B.; "Global coupled EM-electrical-thermal simulation and experimental validation for a spatial power combining MMIC array" *IEEE Transactions on Microwave Theory and Techniques*, Volume: 50, Issue: 12, Pages: 2820 - 2833, Dec. 2002
- Sean Ortiz, John Hubert, Lee Mirth, Erich Schlecht and Amir Mortazawi, "A High Power ka-Band Quasi-Optical Amplifier Array," *IEEE Transactions on Microwave Theory and Techniques*, Volume: 50, Issue: 2, Feb. 2002, Pages: 487 - 494
- F. Ayguavives, Z. Jin, J. P. Maria, A. Tombak, A. Mortazawi, A. I. Kingon, G. T. Stauf, C. Ragaglia, J. F. Roeder and M. Brand, "Contribution of dielectric and metallic losses in RF / microwave tunable varactors using (Ba,Sr)TiO₃ thin films." *Integrated Ferroelectrics*, 39, pp. 1343 - 1352, 2001
- G. T. Stauf, C. Ragaglia, J. F. Roeder, D. Vestyk, F. Ayguavives, J. P. Maria, A. Tombak, A. Mortazawi and A. I. Kingon., "Thick electrodes for high frequency high Q tunable ferroelectric thin film varactors", *Integrated Ferroelectrics*, 39, pp. 1271 - 1280, 2001

Service: Professor Mortazawi has an exemplary record of service both internal to the Department of Electrical Engineering and Computer Science and externally in professional societies. Internally, he is

serving as the chair of the EE graduate committee as well as being an area-wide advisor to applied electromagnetics (Radiation Laboratory) graduate students. Externally, he has served as an associate editor of the IEEE Transactions on Antennas and Propagation and the IEEE Transactions on Microwave Theory and Techniques. He also has assumed leadership positions in international organizations as evidenced by his recent election to the Administrative Committee of the IEEE Microwave Theory and Techniques Society.

External Reviewers:

Reviewer (A): "... very impressive, advancing, and accurate." "As for the Spatial Power Combiner design, he is the top-ranked in the world."

Reviewer (B): "His group has done the best work in combining discrete amplifiers in the millimeter-wave range"

Reviewer (C): "His publication record is solid and steady over a 15-year span." "Amir is an animated speaker with clear organization, sharp wit and the ability to engage his audience in his lectures."

Reviewer (D): "Dr. Mortazawi has been very active in the field of quasi-optical power combining technology and has published a number of break-through papers ... he has record [sic] of 25 W output at Ka-band using his design"

Reviewer (E): "Dr. Mortazawi is a productive researcher and his progress in performing advanced research is quite admirable."

Reviewer (F): "... very ordered, structured, and thorough."

Summary of Recommendation: Professor Mortazawi is uniformly recognized as a world-renowned experimentalist in the field of microwave and millimeter-wave circuits, and has done a remarkable job of balancing research, teaching, and service activities. His internal letters demonstrate that Professor Mortazawi is well respected at Michigan for his commitment to teaching and research, and for bringing practice and design into the classroom. It is with the support of the College of Engineering Executive Committee that I recommend him for promotion to professor of electrical engineering and computer science, with tenure, Department of Engineering and Computer Science, College of Engineering.



Ronald Gibala
Interim Dean, College of Engineering

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