Raymond C. Rumpf, PhD, FSPIE, SMIEEE

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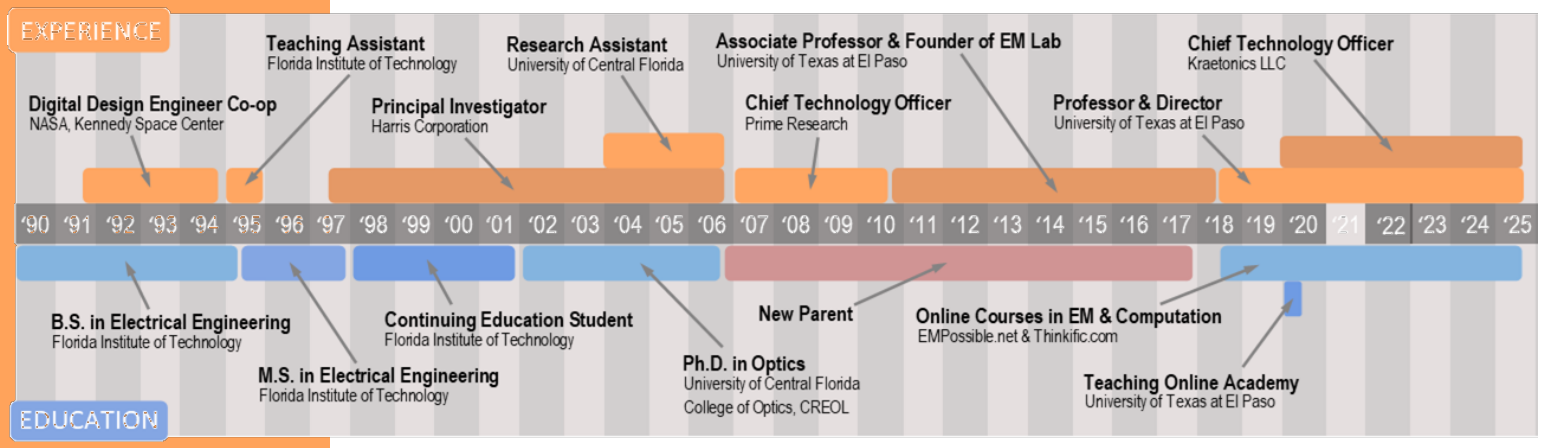
INNOVATIVE • AMBITIOUS • BUSINESS DEVELOPMENT • MOTIVATING LEADER

Dynamic, results-oriented Engineer/Scientist/Leader with extraordinary record of accomplishments in business, research, education, and innovation. Helped transform technology portfolio for Prime Research LC, to position it for unlimited opportunities in commercial and government sectors, including DoD. Founded EMLab with a mission to develop revolutionary technologies enabled by 3D printing and delivered an array of significant breakthroughs in a short time. Founded Kraetonics LLC helped turn it into multi-millian dollar company in first three years. Skilled in forecasting technology trends, building and nurturing teams, performing business development, writing proposals, directing research, and managing intellectual property. Able to make sound decisions based on limited data and to originate and direct high-risk/high-payoff research. Energetic, motivating, and extremely ambitious.



Core Competencies

Technical

- Hybrid 3D printing
- Electromagnetics
- Optics & photonics
- Computational electromagnetics
- Optimization
- Spatially-variant lattices
- Photonic crystals & Metamaterials
- Frequency selective surfaces
- Diffraction gratings
- Waveguides
- Advanced packaging of electronics

Nontechnical

- Technical writing
- Mentoring & education
- Graphics & visualization
- Business strategy
- Business development
- Motivating leader
- Managing risk
- Presentations
- Proposal writing

— Interest Areas —

- Hybrid additive manufacturing
- Electromagnetics & photonics
- Leadership, education & mentoring
- Entrepreneurship

— Major Awards & Recognitions —

- Research & Innovation Award, UTEP 2024.
- Senior Member, National Academy of Inventors, 2024.
- Top 2% of Cited Researchers, Stanford University 2024.
- Florida Tech Career Hall of Fame, 2020.
- 2015 UT Regents' Outstanding Teaching Award
- D. E. T. Outstanding Faculty Member, 2017.
- Schellenger Prof. in Electrical Research
- BUILDing SCHOLARS & COE Mentoring Award
- Dean's Award for Excellence in Research, 2019.
- Dean's Award for Teaching, 2012 & 2015
- Fellow SPIE, 2019
- Senior Member IEEE, 2019
- Best Photonics Technology 2015, Opli Mag.
- Research in 3D printed EM featured by IET
- Miguel Izquierdo Endow. for Outst. Teaching
- DARPA Young Faculty Award, 2011-2013
- Five Official World Records in Skydiving

— Key Accomplishments —

Business

- Transformed company's technology portfolio
- Awarded >$10M in research
- More than doubled number of new programs
- Managed company intellectual property (IP)
- Awarded 19 US patents

Research

- First to automate hybrid direct-write 3D printing
- First-ever 3D volumetric circuits
- Tightest bend of unguided optical beam
- Highest power frequency selective surface
- Widest FOV and most broadband dielectric filter
- Thinnest all-dielectric antenna

Teaching

- Wrote a textbook on computational EM
- Developed six grad courses + two online
- Graduated 9 PhD, 8 MS, & 5 BS students
- Developed multiple online courses
- Top student evaluations in department

Service

- Mentor & coach numerous students in 3rd-world countries
- Associate Editor for SPIE
- Faculty Advisor for IEEE Eta Kappa Nu
- Outreach to middle and grade schools

PROFESSIONAL EXPERIENCE

University of Texas at El Paso, El Paso, TX 2010 – Present

Full Professor, Electrical & Computer Engineering 2018 – Present
Associate Professor, Electrical & Computer Engineering 2010 – 2017
Director, EMLab 2010 – Present

Established the EMLab to develop revolutionary technologies in electromagnetics, photonics, and additive manufacturing (i.e. 3D printing). Developed and patented an array of breakthroughs, including first automated hybrid 3D printing, first 3D volumetric circuit, preservational spatially-variant lattices, highest power frequency selective surface, and invention/discovery of multiple new electromagnetic phenomena. Developed and taught six new graduate courses and four undergraduate courses in electromagnetics, computation, and research methods. Awarded close to $7M in external research funding as PI.

Graduated Students: 9 PhD in ECE, 1 PhD in CPS, 8 MS in ECE, 5 MS in CPS, and numerous BS in ECE

Kraetonics LLC, Melbourne Beach, FL 2015 – Present

Founder & Chief Technology Officer 2015 – Present

Responsible for technology strategy, business development, intellectual property, and technical management of research and development activities. Award over $2M in research funding in two years. Commercialized OmniSlice®, a slicer for hybrid additive manufacturing with advanced capabilities including hybrid 3D printing of multi-material structures, functionally-graded materials, conformal printing, and more. Commercializing algorithms to wrap periodic structures over doubly-curved and irregular surfaces.

Prime Research LC, Blacksburg, VA 2006 – 2010

Chief Technology Officer 2006 – 2010

Responsible for strategic planning, business development, intellectual property, and technical management of research and development activities. Provided vision and strategic plan that transformed Prime Research and positioned company for new opportunities in commercial and government sectors, including DOD. Redesigned proposal process and generated over $5M in advanced research and development funds in less than three years and more than quadrupled the number of new programs. Proposal win rate approaching 90%. Managed and negotiated more than 11 government contracts. Participated in trade shows and conferences.

Harris Corporation, Palm Bay, FL 1997 – 2006

Principal Investigator, Microsystems Technology Group 2000 – 2006
Senior Electrical Engineer, Government Communications Systems Division 1997 – 2000

Responsible for identifying and developing revolutionary technologies to radically miniaturize communications systems. Technologies included microelectronics, advanced packaging, thermal management, antennas, materials, power generation, energy harvesting, radio, communications, signal processing, photonics, MEMS, and more.

NASA, Kennedy Space Center, FL 1992 – 1994

Digital Design Engineer Co-Op, Developmental Systems 1992 – 1994

Responsible for designing and testing digital circuits and software for NASA's Central Data Storage System. Technical duties included circuit design, layout, and testing as well as software development to control digital circuits. Digital circuits were based on the VMEbus architecture.

EDUCATION

University of Central Florida, Orlando, FL 1999 – 2006

Ph.D. in Optics, GPA 4.0/4.0, The College of Optics and Photonics (CREOL) 2006
Dissertation: *Design and Optimization of Nano-Optical Elements by Coupling Fabrication to Optical Behavior*
Advisor: *Dr. Eric Johnson*

- Pioneered design of nanophotonics by combining simulations of fabrication with simulations of optical behavior.

- First to fabricate 3D photonic crystals on a standard UV mask aligner. Technique was near-field nano-patterning.
- Founded and led UCF Numerical Modeling Focus Group that was open to all students.
- Developed tuning process used during fabrication of guided-mode resonant filters to control spectral response.
- Investigated space-variant photonic crystal filters for computational imaging applications.
- Investigated fabrication of high aspect ratio form-birefringent devices by autocloning.
- Developed numerical tools to simulate micro- and nano-fabrication including photolithography, developing, chemical deposition, autocloning, and plasma etching processes.
- Developed FDTD for dispersive materials based on a Lorentz-Drude model of arbitrary order.
- Investigated methods for passive alignment of micro-optic structures including fiber micro-grippers.

Florida Institute of Technology, Melbourne, FL 1990 – 1997

M.S. in Electrical Engineering, GPA 4.0/4.0 1997
Thesis: *Fiber Optic Temperature Sensor*
Advisor: *Dr. Barry Grossman*

- Designed and built complete fiber optic temperature sensing system using extrinsic Fabry-Perot interferometer attached to a thin aluminum rod.
- Designed and built fiber optic RS-232 data link connecting a printer to a computer.
- Designed and built velocity detection system using micro-bend fiber optic sensors embedded in the ground

B.S. in Electrical Engineering, GPA 3.74/4.0 1995
Senior Design: *Surveillance Robot*

- Developed surveillance robot that was fully programmable or could follow a reflective path and autonomously avoid obstacles. Equipped robot with custom-designed wireless video transmitter aimed by remote control.

MEMBERSHIPS & CERTIFICATIONS

- Fellow, International Society for Optical Engineering (SPIE)
- Senior Member, National Academy of Inventors, Class of 2024.
- Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
- Optica, formerly The Optical Society of America
- Amateur Radio Relay League (ARRL)
- Extra Class Amateur Radio Operator (AG4YV), Federal Communications Commission
- Volunteer Examiner Coordinator, Federal Communications Commission
- Travelling Lecturer for Optica
- Advanced Scuba Diver, Professional Association of Diving Instructors
- Master Skydiver, USPA
- Order of Omega, Greek Leadership Honor Society
- Tau Beta Pi, National Engineering Honor Society
- Eta Kappa Nu, National Electrical and Computer Engineering Honor Society
- Blue Key, National Honor Fraternity
- Pi Lambda Phi Fraternity, Florida Delta Upsilon Chapter

HONORS, AWARDS, & RECOGNITIONS

- Awarded the Research & Innovation Award – Established Innovator, University of Texas at El Paso, April 2024.
- Top 2% of Cited Researchers through end of 2022, Stanford University, 2023.
- Senior Member, National Academy of Inventors, Class of 2024.
- Florida Tech Hall of Fame, 2020.
- Dean's Award for Excellence in Research, 2019.
- Dean Eugene Thomas Award for Outstanding Faculty Member, 2017.
- Keynote Speaker at University of Texas at El Paso Research Forum, 2016
- Distinguished Speaker at University of Central Florida, 2016.
- BUILDing SCHOLARS & College of Engineering Mentoring Award, 2015.Dean's Award for Teaching, May 2015.
- Best Business Plan, Paso del Norte Venture Competition, March 2015.
- Featured Engineer, EEWeb.com, Feb. 2015.
- Best in 2015, EM Lab Photonics Technology, Opli Magazine.
- Invited Speaker at Royal Society Meeting on Spatial Transforms, Jan. 2015.
- Research featured on IET website, June 2013.
- Grant Award Recognition, Office of Research and Sponsored Projects, Dec. 2014.
- Awarded the Miguel Izquierdo Endowment for Outstanding Teaching, 2012.

- Distinguished Speaker at University of Wisconsin-Madison.
- Nominated for Texas Inventor of the Year, 2016.
- Certificate of Recognition for Excellence in Teaching, State of Texas, Jose R. Rodriguez, State Senator District 29, September 2015.
- Star On The Mountain Award, City of El Paso, 22 September 2015.
- Schellenger Professorship in Electrical Research, 2015.
- University of Texas Regents' Outstanding Teaching Award, 2015.
- Numerous invited talks and distinguished lectures
- Research Award in Electrical and Computer Engineering, May 2012.
- Dean's Award for Teaching, May 2012.
- College Marshall, May 2012 & 2015.
- Recipient, DARPA Young Faculty Award, 2011–2013.
- Master of Ceremony, First Lego League of Southwest Virginia, 2007–2009.
- Finalist for Student of Year, University of Central Florida, 2006.
- Best Paper Award, SPIE Conf. on Micromachining Technol. For Micro- and Nano-Optics, 2006.
- Five Official World Records in Skydiving for Largest Parachute Formation.

ORANGIZATIONAL ACTIVITIES & SERVICE

- **EMProfessor**, answer dozens of questions per week from around the world. Informal coach/mentor of multiple students in third-world countries, 2016 – present.
- **Travelling Lecturer**, Optica, 2019 – present.
- **Chair**, multiple Faculty Search Committees, 2017, 2019 – 2023.
- **Member,** UTEP Search Committee for Vice President of Research, 2022-2023.
- **Associate Editor**, SPIE Optical Engineering, 2010 – 2022.
- **Associate Editor**, Journal of Electronic Materials, 2013 – 2015.
- **New Faculty Mentor**, for Dr. Robert Roberts, 2020 – present.
- **New Faculty Mentor**, for Dr. Sai Mounika, 2020 – present.
- **Faculty Mentor**, UTEP Faculty-Student Mentoring Program, 2012.
- **Co-Chair, Photonics West**, MOEMS & Advanced Fabrication Technologies, 2009 to 2018.
- **Co-Chair**, MRS Symposium on Three-Dimensional Micro-Fabrication, 2009.
- **Faculty Advisor**, Eta Kappa Nu, 2012 – present.
- **Member**, Teaching Effectiveness and Development Committee, 2015 – 2016.
- **Member**, Senior Design Committee, 2011 – present.
- **Member**, Fields and Devices Committee, 2011 – present.
- **Member**, Multiple Faculty Evaluation and Tenure & Promotion Committees, 2018 – present.
- **Mentor**, 6th grade student for science project investigating effect of wire gauge on strength of an electromagnet.
- **Mentor**, high school student in analysis, design, and construction of Acoustic Life Aid for Roaming Manatees (ALARM) for a winning high school science fair project.
- **Reviewer**, conducted numerous peer reviews of proposals and manuscripts.
- **Master of Ceremony**, First Lego League Competition in southern Virginia, 2008 to 2009.
- **Volunteer**, Boy Scouts and Girl Scouts, 2015 to 2022.

CONTRACTS & GRANTS

The following table summarizes just the projects where I served as Principal Investigator. Total amount is multiple times higher if collaborative and Co-PI roles are considered.

	Year	Project	Customer	Amount
Kraetonics LLC	2025	Phase 2 - Computer Aided Design Tool for SVL FSS	AFRL	$2,000,000
	2024	Phase 1 - Computer Aided Design Tool for SVL FSS	AFRL	$150,000
	2024	Deveopment of initial BINDIV capability	ARPA-H	$500,000
	2024	Parameter Optimziation of CUA	DARPA	$130,000
	2024	Design of Conformal Frequency Selective Surfaces - Phase 3	AFRL	$75,000
	2023	Design of Conformal Frequency Selective Surfaces - Phase 2	AFRL	$36,500
	2023	Design of Conformal Frequency Selective Surfaces - Phase 1	AFRL	$7,500
	2022	OmniSlice™ Plug-in for Third-Party CAD	ARL	$250,000
	2020	Additive Manfucturing of Functionally Graded Materials	ARL	$250,000
University of Texas at El Paso (UTEP)	2025	Phase 2 - Computer Aided Design Tool for SVL FSS	K	$500,000
	2024	Microscale Metamaterial Antennas	Sandia	$750,000
	2024	Additive Manufacturing for EM Devices	ARL	$150,000
	2024	Phase 1- Computer Aided Design Tool for SVL FSS	K	$50,000
	2023	AI Design of Novel Antennas	ARL	$150,000
	2023	Develop Novel 3D Antennas & Devices for Army Applications	ARL	$60,000
	2023	Simulation of Conformal FSS Structures	K	$7,500
	2023	Spatially Variant Self-Collimating Photonic Crystals - Phase 2	Ball	$40,000
	2022	Spatially Variant Self-Collimating Photonic Crystals - Phase 1	Ball	$40,000
	2022	Hybrid AM of 3D Antennas	Army	$60,000
	2022	Hybrid Printing of 3D Sensor Circuits for UAVs	Eaton	$225,000
	2022	Hybrid FDTD and Ray Tracing Continuation	Google	$55,000
	2021	Hybrid FDTD and Ray Tracing	Google	$55,000
	2021	Development & Validation of Design Tools for Meta-Optics (cont'd)	AFRL	$150,000
	2021	Hybrid 3D Printing of Volumetric Circuits	Eaton	$225,000
	2021	Conformal Printing of Periodic Structures	DOE	$150,000
	2020	Development & Validation of Design Tools for Meta-Optics	AFRL	$150,000
	2020	3D Printed Photomultiplier Circuits	DTRA	$35,000
	2020	Hybrid 3D Printing of Electrical & Electromagnetic Structures	ARL	$165,000
	2020	Develop Novel 3D Antennas & Devices for Army Applications	ARL	$304,000
	2020	Additive Manufacturing Development & Analysis	ARL	$225,000
	2020	High-Performance Computing Platform Development	DOE	$140,000
	2019	Transforming Flexible Hybrid Electronics Through 3D Printing	FlexTech	$650,000
	2018	3D Printed Integrating Sphere	nScrypt	$30,000
	2018	3D Printed Antennas for High-G	ARL	$250,000
	2017	Photon Funnels	NSF	$150,000
	2017	Study of Asymmetric Electromagnetic Devices	LMC	$25,000
	2017	3D Printing for RF Sensor Systems	AFRL	$200,000
	2017	3D Printed High-Frequency Circuits	ARL	$120,000
	2017	SVAMs for MIMO Applications	Rogers	$84,000
	2016	Modulated Reflective Metasurface	LMC	$75,000
	2016	3D Conformal Meta-Optics (3D-COMET)	UNCC	$34,000
	2016	Optical Simulation of Selective Laser Melting	ARL	$50,000
	2015	Vector Signal Analyzer/Generator for 3D Printed Circuits	Keysight	$400,000
	2015	Spatially-Variant Anisotropic Metamaterials for Improved EMC	Texas	$50,000
	2014	Ultra-Wideband Antennas	ARL	$30,000
	2014	All-Dielectric Antennas	NPS	$272,000
	2013	3D Printed Structures by Micro-Dispensing	Raytheon	$40,000
	2012	Direct Digital Manufacturing of 3D Metamaterial Devices - Option	DARPA	$150,000
	2011	Direct Digital Manufacturing of 3D Metamaterial Devices - Base Effort	DARPA	$150,000
	2011	Evaluation of 3D Printed Impedance Elements	LMC	$14,400
	2010	STARS	Texas	$250,000
	2010	All-Dielectric Frequency Selective Surfaces for High Power Microwaves	PPLC	$167,000
Prime Photonics LC (PPLC)	2010	Ultra-Low Power CMOS Radar	NASA	$100,000
	2010	High Power Microwave Frequency Selective Surfaces -- Phase 2	AFRL	$750,000
	2010	Nano-Optical Elements for Multi-Mode Imaging	AFRL	$100,000
	2009	High Power Microwave Frequency Selective Surfaces -- Phase 1	AFRL	$99,912
	2009	Meta-Optic Fluorescence Probe	DARPA	$98,962
	2009	Power Harvesting Wireless Flow Sensor	DARPA	$98,976
	2009	Full-Field Strain Sensor	Navy	$69,997
	2009	Ultra-High Temperature Metamaterials for Wireless Sensing	DOE	$810,929
	2008	Optowireless	NSF	$150,000
	2008	Nano-Optical Elements for Polarization Selective Infrared Detection	AFRL	$99,797
		TOTAL KRAETONICS:		**$3,399,000**
		TOTAL UTEP:		**$6,877,900**
		TOTAL PPLC:		**$2,378,573**
		TOTAL:		**$12,655,473**

BUSINESS ACCOMPLISHMENTS

- **Kraetonics LLC, Melbourne Beach, Florida**
  - Co-Founded Kraetonics LLC, Melbourne, Florida, to commercialize EMLab technology and other technologies in digital manufacturing, electromagnetics, computation, and more.
  - Served as Chief Technology Officer, 2015 – present.
  - Secured over $3M in research funding in first three years.
  - Developed and commercialized OmniSlice®, a modern slicer capable of hybrid 3D printing, conformal and off-axis 3D printing, printing of functionally-graded materials, and more.
  - Submitted 1 USA and 1 PCT patent application, “Systems and Methods for Predictive Tool Path Planning for Additive Manufacturing of Functionally Graded Materials,” 2023.
  - OMNISLICE, Trademark Application 97/562,516, 2022.
  - Obtained Exclusive License for "3D Volumetric Circuits and Associated Methods," US Patent 16/678,557” from University of Texas at El Paso, 2022 – present.
- **EMPossible.net, El Paso, Texas**
  - Founded EMPossible.net with a mission to deliver quality learning materials in electromagnetics and computation. Most content is offered free to the public as a service activity, but company also develops college-level online courses for profit.
  - Developed dozens of online courses.
  - Profits exceeded $100k in just first two years of business.
  - EMPOSSIBLE®, Trademark, 97/510,127, 2022.
- **EMLab, University of Texas at El Paso, El Paso, Texas**
  - Founded the EMLab with a mission to develop revolutionary technologies in electromagnetics, photonics, and additive manufacturing.
  - Served as Director of EMLab, 2010 – present.
  - Awarded nearly $7M in external funding.
  - Achieved multiple technological discoveries, breakthroughs, and first-ever achievements.
  - Awarded three USA patents, one PCT, and others pending.
  - Secured one license agreement "3D Volumetric Circuits and Associated Methods," US Patent 16/678,557” from Kraetonics LLC, 2022 – present.
  - Awarded Best Business Plan, Paso del Norte Venture Competition, March 2015.
- **Prime Research LC, Blacksburg, Virginia**
  - Served as Chief Technology Officer, 2006 – 2010.
  - Generated major new revenue by diversifying technologies to include sensors, communications, and engineered materials for extreme applications, rather than company's relying on a single, underperforming fiber optic sensor.
  - Led Prime Research LC to win over $4.3 million in government contracts for advanced R&D and product development.
  - More than doubled number of new programs by redesigning proposal process as well as contributing ideas and innovations.
  - Funded research and development by taking advantage of federal Small Business Innovation Research (SBIR) program as funding source.
  - Achieved $3.4 million in SBIR funding in less than three years, 2007 – 2010.
  - Won and directed over a dozen government contracts in industry where ten were SBIR programs.
  - Dramatically expanded company's intellectual property (IP) portfolio.
  - Significantly increased research capabilities and prospects by partnering with many new industry and university researchers.
  - Developed staff through cross-training, "lunch-and-learn" seminars, and short courses.
  - Motivated staff by winning exciting research and creating a relaxed, friendly, and risk-tolerant work environment.
  - Restructured company business model from commercializing IP from a single licensed source to generating its own IP, collaborating with industry, and directing research at multiple universities.

RESEARCH ACCOMPLISHMENTS

- **Honors, Awards, and Recognitions**
  - Top 2% of cited researchers through end of 2022, Stanford University, 2023.
  - Research & Innovation Award – Established Innovator, University of Texas at El Paso, 2024.
  - Senior Member, National Academy of Inventors, class of 2024.
  - Florida Tech Career Hall of Fame, 2020

- Named Fellow of SPIE, 2019.
- Named Senior Member IEEE, 2019
- Awarded 16 US patents across a broad range of disciplines.
- Authored many dozens of articles, cited 3400+ times, h-index 28, and i10-index 54 (as of April 2024).

- **Computational Electromagnetics & Numerical Methods**
  - Finite-difference time-domain (FDTD)
  - Finite-difference frequency-domain (FDFD)
  - Unstructured grids for finite-differences
  - Method of Lines (MoL)
  - Finite element method (FEM)
  - Method of moments (MoM)
  - Genetic algorithms (GA)
  - Particle swarm optimization (PSO)
  - Simulated annealing
  - Transformation optics (TO)
  - Slicer for additive manufacturing
  - Transfer matrix method (TMM)
  - Improved scattering matrices for semi-analytical methods
  - Plane wave expansion method (PWEM)
  - Rigorous coupled-wave analysis (RCWA)
  - Slice absorption method (SAM)
  - Beam propagation method (BPM)
  - Level set methods (LSM)
  - Fast marching method (FMM)
  - Cell volume method (CVM)
  - String method
  - Spatially-variant lattices algorithm
- **Additive Manufacturing Innovations**
  - First to automate direct-write hybrid additive manufacturing. Remains the only known capability in the world to build 3D structures from any distribution of conductors, dielectrics, magnetics, and other materials.
  - OmniSlice™ – Developed an advanced slicer for additive manufacturing. Capable of hybrid 3D printing, conformal printing, off-axis printing, printing parts made of functionally-graded materials, and more.
  - First to develop a slicer capable of designing and manufacturing parts made of functionally-graded materials.
- **Electromagnetic and Photonic Innovations**
  - *Spatially-Variant Lattices (SVLs)* – Developed an algorithm that can bend, twist, conform, functionally grade, and otherwise spatially-vary periodic structures while minimizing the size, shape, and spacing of the unit cells. These "impossible" geometries preserve the electromagnetic or photonic properties of the lattice and unlock new physical mechanisms from which to build devices.
  - *Wrapping Periodic Structures Over Doubly-Curves Surfaces* – Modified SVL algorithm to wrap planar periodic structures over abrupt doubly-curved surfaces, while maintaining the size, shape and spacing of unit cells. Demonstrated using frequency selective surfaces.
  - *Spatially-Variant Anisotropic Metamaterials (SVAMs)* – Discovered that near fields around components can be sculpted like clay by embedded them in an anisotropic dielectric medium where the orientation of the anisotropy is spatially-varied. Development includes the metamaterial structures and algorithms for generating the SVAMs structures.
  - *Spatially*-Variant *Photonic Crystals (SVPCs)* – Invented a new way to control light by spatially varying self-collimating photonic crystals. Invention led to tightest bend of an unguided optical beam that won Best Photonics Technology 2015 by Opli Magazine.
  - *Photon Funnel* – Invented concept of lens operating in SVPCs where refraction is suppressed. Light is flowed straight through lens regardless of angle of incidence. Concept holds great promise for imaging systems with extremely wide field-of-view.
  - *Photon Funnel* – Invented concept of a photon funnel where light incidence at any position and at any angle of incidence is flowed to common collection region. Concept being used to improve signal-to-noise ratio in photodetectors as well as a mechanism to relax optical alignments.
  - *High-Power Microwave Frequency Selective Surface* – Demonstrated a record-breaking FSS operating well over 2.0 GW at 10 GHz. Same device also broke records for operating bandwidth from a subwavelength thick layer of dielectric.
  - *Integrating Plane* – Invented and demonstrated a concept to radically miniaturize an integrating sphere. Based on pseudo-random spatially-variant photonic crystals.
  - Demonstrated a 3D printed antenna operating closer to fundamental limits than any other 3D printed antenna known.
  - Developed and demonstrated world's thinnest all-dielectric antenna, operating at 2.4 GHz.
  - Invented a series of devices based on magnet-dielectric fluids for tuning and miniaturizing electromagnetic components.
  - Invented a wireless sensor concept for measuring temperature in the hostile environment of a coal gasifier.
  - Invented ceramic MEMS switch for radio and microwave frequency circuits.
- **Other Innovations**
  - *3D Volumetric Circuits (3DVCs)* – First to demonstrate a 3DVC manufactured using an automated hybrid 3D printing process. Components can be located at any position (x, y, z) and placed in any orientation (θ, ϕ). Interconnects can meander smoothly throughout all three dimensions following smooth paths. Circuits can be any form factor and exploit physics not feasible in planar circuits. Great design freedom promises tremendous savings in size, weight and power (SWaP).
  - *3DVC Layout and Routing Tool* – First to develop a custom tool for layout of components and routing and interconnects in 3DVCs. Tool was developed as an add-on to the open-source software Blender.
  - Wireless sensor concept for operation in the hostile environment of a coal gasifier.
  - Magneto-dielectric materials for tuning and miniaturizing electromagnetic components.
  - Ceramic MEMs switch for radio and microwave frequency circuits.
  - Explored heat pipes and micro-capillary pumped loops for thermal management in LTCC hybrid circuits.

TEACHING ACCOMPLISHMENTS

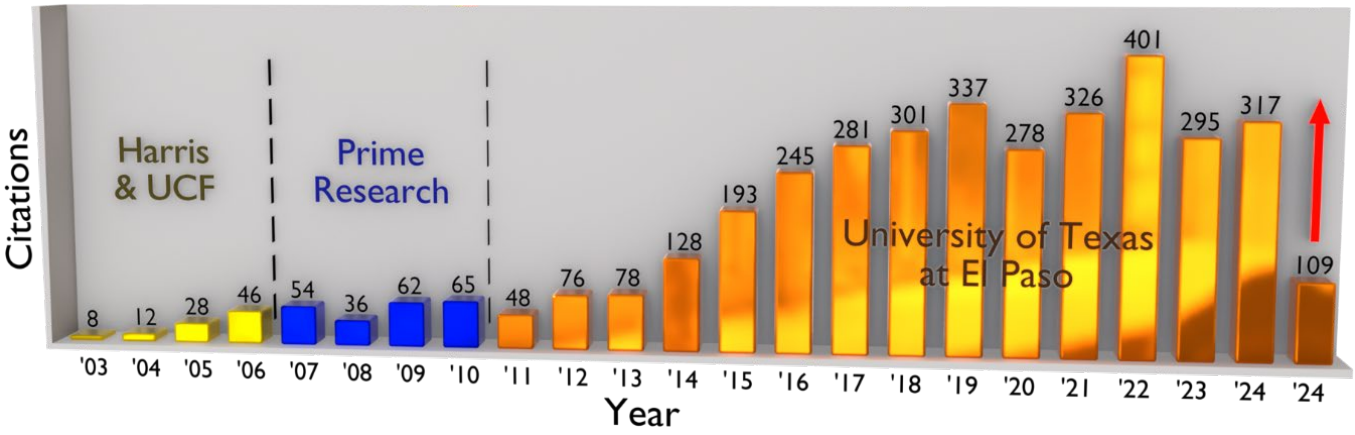
- **Honors, Awards, and Recognitions**
  - Full & Tenured Professor, University of Texas at El Paso, El Paso, Texas, 2018.
  - Awarded, Dean Eugene Thomas Award for Outstanding Faculty Member, 2017.
  - Awarded, University of Texas Regents' Outstanding Teaching Award, 2015. Largest and most prestigious award offered by the University of Texas system.
  - Awarded, BUILDing SCHOLARS Mentoring Award, 2015.
  - Best MS Thesis in Computational Science awarded to Asad Gulib for this thesis titled "Numerical Calculation of Spatially-Variant Anisotropic Metamaterials (SVAMs)."
  - Best Ph.D. Dissertation in the College of Engineering awarded to Cesar Garcia for his dissertation titled "3D Printed Spatially Variant Anisotropic Metamaterials."
- **EMPossible.net, El Paso, Texas**
  - Founded EMPossible.net with a mission to deliver quality learning materials in electromagnetics and computation.
  - Developed dozens of online courses.
  - Complicated concepts are taught visually using stunning graphics and animations.
    https://empossible.net/
  - Developed multiple online courses available at thinkific.com.
    https://empossible.thinkific.com/collections
- **University of Texas at El Paso, El Paso, Texas**
  - Students Graduated – 9 PhD in ECE, 8 MS in ECE, 1 MS in CPS, and numerous BS in ECE.
  - Developed course websites for most courses taught that provided 24/7 access to homework, notes, recorded lectures, and other resources to the students.
  - Accommodated many remote students in four of the graduate courses taught.
  - Consistently receive excellent reviews from students.
- **Graduate Courses Taught and/or Developed:**
  - EE 5392/6392 Research Methods
    https://empossible.net/academics/research-methods/
    This course is intended to help students thrive in graduate school. It covers techniques, tools, and skills needed to evaluate, document, and disseminate research in STEM. The course emphasizes professional communications to include writing, speaking, and graphics.
  - EE 5303 Electromagnetic Analysis Using FDTD
    https://empossible.net/academics/emp5304/
    A course on the finite-difference time-domain method for rigorous analysis of electromagnetic devices. The course covers the detailed formulation and how to implement the method in MATLAB. Topics include MATLAB, data visualization, finite-differences, Yee algorithm, perfectly matched layer absorbing boundary condition, sources, Fourier transforms, and modeling of electromagnetic devices.
  - EE 5320 Computational Electromagnetics
    https://empossible.net/academics/emp5337/
    A course covering many of the most popular methods used in modern computational electromagnetics. Methods include transfer matrix method, finite-difference frequency-domain, finite-difference time-domain, beam propagation method, plane wave expansion method, rigorous coupled-wave analysis, method of lines, slice absorption method, finite element method, and optimization.
  - EE 5322 21st Century Electromagnetics
    https://empossible.net/academics/21cem/
    A comprehensive study of the most advanced concepts in modern electromagnetics. Topics include dispersive and anisotropic materials, transmission lines, coupled-mode theory, periodic electromagnetic structures, gratings, guided-mode resonance, metamaterials, photonic crystals, transformation optics, spatially variant lattices, frequency selective surfaces, surfaces waves, and slow waves. Problems associated with interfacing CAD and MATLAB are also covered.
  - EE 5390 Advanced Electromagnetic Design
    Incorporated elements from both Computational Electromagnetics and 21st Century Electromagnetics described above.
  - EE 5390 Microwave Engineering
    https://empossible.net/academics/emp4301_5302/
    Broad introduction to the area of microwave engineering. Topics include basic electromagnetic theory, electromagnetic properties of materials, waves, network theory, waveguides, Smith Charts, impedance matching, and metamaterials.
  - EE 5301 Computational Methods for Electrical Engineers
    https://empossible.net/academics/emp4301_5301/
    An introduction to numerical computation. Course begins with an introduction MATLAB, graphics, and visualization. Topics

include linear algebra, interpolation, root finding, curve fitting, optimization, and solving differential equations using the finite-difference method. Algorithms are applied to topics that arise in electrical engineering.

- **Undergraduate Courses Taught:**
  - EE 3321 Electromagnetic Field Theory
    https://empossible.net/academics/emp3302/
    Fundamentals of the electromagnetic model are developed for static and magnetic fields, for the propagation of electromagnetic waves in various media and for reflection and refraction at material interfaces. Basic applications of the model to transmission lines, waveguides, and radiating systems are developed.
  - EE 4347 Applied Electromagnetics
    https://empossible.net/academics/emp3302/
    In depth study and application of electromagnetics. Topics include waves, polarization, transmission lines, waveguides, computational electromagnetics, and modern topics including metamaterials and photonic crystals.
  - EE 4380 Microwave Engineering
    Broad introduction to the area of microwave engineering. Topics include basic electromagnetic theory, electromagnetic properties of materials, waves, network theory, waveguides, Smith Charts, impedance matching, and metamaterials.
  - EE 4386 Computational Methods for Electrical Engineers
    https://empossible.net/academics/emp4301_5301/
    An introduction to numerical computation. Course begins with an introduction MATLAB, graphics, and visualization. Topics include linear algebra, interpolation, root finding, curve fitting, optimization, and solving differential equations using the finite-difference method. Algorithms are applied to topics that arise in electrical engineering.
  - EE 4395 Advanced Electromagnetic Design
    First course taught at UTEP. It covered some computational electromagnetics as well as advanced electromagnetic theory.
- **Online Courses Developed:**
  - One-Dimensional Finite-Difference Time-Domain with MATLAB
    https://empossible.thinkific.com/courses/1D-FDTD
    Teaches the core concepts of finite-difference time-domain to the complete beginner. Course includes theory videos and videos of MATLAB coding sessions where every line of code is typed and explained. Topics include formulation of equations and discussion of implementation. Devices simulated include thin film optical filter, layered photonic crystal, and a fiber optic Bragg grating.
  - Two-Dimensional Finite-Difference Time-Domain with MATLAB
    https://empossible.thinkific.com/courses/2d-fdtd-in-matlab
    Builds on the 1D FDTD course to formulate and implement two-dimensional finite-difference time-domain for the complete beginner. Course includes theory videos and videos of MATLAB coding sessions where every line of code is typed and explained. Topics include formulation of equations, techniques for modeling devices, perfectly matched layer absorbing boundary, total-field/scattered-field technique, and implementation in MATLAB. Devices simulated include a diffracting grating, guided-mode resonance filter, and a photonic crystal.
  - Three-Dimensional Finite-Difference Time-Domain for Periodic Structures with MATLAB
    https://empossible.thinkific.com/courses/3d-fdtd-in-matlab
    Builds on the 1D and 2D FDTD courses to formulate and implement three-dimensional finite-difference time-domain for the complete beginner. A strong emphasis is placed on simulating periodic structures like metamaterials, metasurfaces, frequency selective surfaces, photonic crystals, diffraction gratings, etc. Course includes relevant electromagnetic theory, new concepts for 3D FDTD, and many MATLAB coding sessions where every line of code is typed and explained. Examples include photonic band calculation, Mie scattering, parameter retrieval from a metamaterial, and scattering from a diffraction grating, frequency selective surface, and photonic crystal slab.
  - Two-Dimensional Plane Wave Expansion Method with MATLAB
    https://empossible.thinkific.com/courses/pwem2dbands
    Teaches the formulation and implementation of the two-dimensional plane wave expansion method for calculating photonic bands. Videos of MATLAB coding sessions show how to construct convolution matrices, calculate symmetry points, path around the irreducible Brillouin zone, calculating the bands, and plotting a professional band diagram.
  - Three-Dimensional Plane Wave Expansion Method with MATLAB
    https://empossible.thinkific.com/courses/pwem3dbands
    Teaches the formulation and implementation of the three-dimensional plane wave expansion method for calculating photonic bands. Videos of MATLAB coding sessions show how to construct convolution matrices, calculate symmetry points, path around the irreducible Brillouin zone, calculating the bands, and plotting a professional band diagram.
  - Three-Dimensional Rigorous Coupled-Wave Analysis in MATLAB
    https://empossible.thinkific.com/courses/rcwa3d
    Teaches the formulation and implementation of the three-dimensional rigorous coupled-wave analysis method. Course includes theory videos and videos of MATLAB coding sessions where every line of code is typed and explained. The RCWA implementation works for any symmetry (square, hexagonal, etc.). As a bonus, techniques for performing parameter sweeps are explained and demonstrated.

- Three-Dimensional Method of Lines in MATLAB
  https://empossible.thinkific.com/courses/mol3d-matlab
  Teaches the formulation and implementation of the three-dimensional method of lines method. Course includes theory videos and videos of MATLAB coding sessions where every line of code is typed and explained. As a bonus, techniques for performing parameter sweeps are explained and demonstrated.
- Numerical Transformation Optics in MATLAB
  https://empossible.thinkific.com/courses/fdmto
  Teaches the numerical implementation of transformation optics so that the method can be applied to any shape. Course covers the finite-difference method, transformation optics, and theory of solving transformation optics using the finite-difference method. Course ends with a series of MATLAB coding sessions where every line of code is typed and explained to design an invisibility cloak.
- Finite-Difference Analysis of Transmission Lines in MATLAB
  https://empossible.thinkific.com/courses/simplefdmtl
  Teaches a simple and fast method to calculate the distributed capacitance, distributed inductance, and characteristic impedance of any shaped transmission line. Videos include MATLAB coding sessions where every line of code is typed and explained. Transmission lines include a microstrip and a differential pair in order to demonstrate both a unbalanced (single ended) and balanced (differential) lines.
- Finite-Difference Waveguide Analysis in MATLAB
  https://empossible.thinkific.com/courses/fdmhybridmodes
  Teaches how to rigorously analyze channel waveguides using the finite-difference method. Course includes theory videos and videos of MATLAB coding sessions where every line of code is typed and explained.
- Transfer Matrix Method in MATLAB
  https://empossible.thinkific.com/courses/tmmmatlab
  Teaches the theory and implementation of the transfer matrix method using an improved form of scattering matrices. Course includes MATLAB coding sessions where every line of code is typed and explained. Course updated to include calculating and visualizing the internal fields.

PEER-REVIEWED PUBLICATIONS



Total Citations: 3850+ **H-Index: 31** **I10-Index: 57**

1. Asad Gulib, Edgar Bustamante and Raymond C. Rumpf, "Conservation of power at the interface between mediums with complex permittivity and complex permeability," accepted for publication in Journal of Modern Optics, May 2025.
2. Edgar Bustamante and Raymond C. Rumpf, "The Finite Element Method for the Spatially-Variant Lattice Algorithm for Volumes and Doubly-curved Surfaces," PIER M, Vol. 134, pp. 47-57, July 2025.
3. Blankenship, Morgan Alecsandre, Edgar Bustamante, and Raymond C. Rumpf. "Transfer Matrix Method for General Bianisotropic Layers." PIER B, Vol. 114, pp. 99-106, August 2025.
4. Klinavičius, Tomas, Gabija Riaubaite, Raymond C. Rumpf, and Tomas Tamulevicius, "Resonant-reflecting/absorbing coatings for maximizing the efficiency of hybrid thermal-electric power generation." Solar Energy Materials and Solar Cells 292 (2025): 113813.
5. Manuel F. Martinez, Edgar Bustamante, Jimmy E. Touma, and Raymond C. Rumpf, "Genetic Algorithm Optimizer for Volumetric Metasurface Elements." 2023 IEEE Research and Applications of Photonics in Defense Conference (RAPID). IEEE, 2023.

6. Asad U. H. Gulib, Jeremie Dumas, Cesar L. Valle, Edgar Bustamante, Daniele Panozzo, and Raymond C. Rumpf, "Generation of Spatially-Variant Anisotropic Metamaterials in 3D Volumetric Circuits," Progress In Electromagnetics Research C, Vol. 134, 93-102, 2023.
7. Valle, Cesar L., Gilbert T. Carranza, and Raymond C. Rumpf, "Conformal Frequency Selective Surfaces for Arbitrary Curvature," in IEEE Transactions on Antennas and Propagation, vol. 71, no. 1, pp. 612-620, Jan. 2023.
8. Horton, Chad L., et al. "Design and fabrication of a metalens with a hexagonal array of intersecting-wall meta-atoms for operation in the near-infrared." 2022 IEEE Research and Applications of Photonics in Defense Conference (RAPID). IEEE, 2022.
9. Martinez, Manuel F., et al. "Formulation of Iterative Finite-Difference Method for Generating Large Spatially Variant Lattices." The Applied Computational Electromagnetics Society Journal (ACES) (2022): 141-148.
10. Chun Xia, Edgar Bustamante, Stephen Kuebler, Raymond C. Rumpf, Noel Martinez, and Jimmy Touma, "Binary-Lens-Embedded Photonic Crystals," Optics Letters, May 2022.
11. Y. Khorrami, D. Fathi, A. Khavasi, & Raymond C. Rumpf, "From asymmetrical transmitter to the nonreciprocal isolator using time-varying metasurfaces." Optical and Quantum Electronics 54.5 (2022): 1-11.
12. Chun Xia, Jesus Gutierrez, Stephen Kuebler, Raymond C. Rumpf, and Jimmy Touma, "Cylindrical-lens-embedded photonic crystal based on self-collimation." Optics Express 30.6 (2022): 9165-9180.
13. Khorrami, Yaser, D Fathi, A Khavasi, and Raymond C. Rumpf, "Method of Lines Framework for Analysis of Arbitrary-shaped Spatial Periodic Structures: A Generalized Formalism." 2022 Workshop on Recent Advances in Photonics (WRAP). IEEE, 2022.
14. Martinez, Noel P., et al. "Photon Funnel Design Based on Spatially Variant Self-Collimating Photonic Crystals." Frontiers in Optics. Optical Society of America, 2021.
15. Yaser Khorrami, D. Fathi, A. Khavasi, & Raymond C. Rumpf, "Dynamical Control of Multilayer Spacetime Structures Using Extended Fourier Modal Method." IEEE Photonics Journal 13.6 (2021): 1-10.
16. Hwang, Seyeon, Sangsup An, Ubaldo Robles, and Raymond C. Rumpf, "Process parameter optimization for removable partial denture frameworks manufactured by selective laser melting." The Journal of Prosthetic Dentistry (2021).
17. Xia, Chun, Stephen M. Kuebler, Noel P. Martinez, Manuel Martinez, Raymond C. Rumpf, "Wide-band self-collimation in a low-refractive-index hexagonal lattice." Optics Letters 46.9 (2021): 2228-2231.
18. Eric A. Berry and Raymond C. Rumpf, "Generating Spatially-Variant Metamaterial Lattices Designed from Spatial Transforms," PIER M, vol. 92, pp. 103-113, 2020.
19. Yaser Khorrami, Davood Fathi, and Raymond C. Rumpf, "Fast optimal design of optical components using the cultural algorithm," Opt. Express 28, 15954-15968 (2020)Yaser Khorrami, Davood Fathi, and Raymond C. Rumpf, "Guided-mode resonance filter optimal inverse design using one- and two-dimensional grating," J. Opt. Soc. Am. B 37, 425-432 (2020).
20. Jesus J. Gutierrez, Noel P. Martinez, and Raymond C. Rumpf, "Independent Control of Phase and Power in Spatially Variant Self-Collimating Photonic Crystals," J. Opt. Soc. Am. A, Vol. 36, No. 9, pp. 1534-1539, 2019.
21. Ubaldo Robles, Edgar Bustamante, Prya Darshni, and Raymond C. Rumpf, "High-Frequency Filters Manufactured Using Hybrid 3D Printing Method," PIER M, Vol. 84, 147-155, 2019.
22. Gilbert Carranza, Ubaldo Robles, Cesar L. Valle, Jesus J. Gutierrez, and Raymond C. Rumpf, "Design and Hybrid Additive Manufacturing of 3D/Volumetric Electrical Circuits," IEEE Trans. on Components, Packaging, and Manufacturing Technology, 2019.
23. Robles, Ubaldo, Andelle Kudzal, and Raymond C. Rumpf. "Automated hybrid 3-D printing of 3-D meandering interconnects." IEEE Transactions on Components, Packaging and Manufacturing Technology 9.6 (2019): 1184-1189.
24. Ubaldo Robles, Justin Kasemodel, Jose Avila, Tenoch Benitez, and Raymond C. Rumpf, "3D Printed Structures by Micro Dispensing Materials Loaded with Dielectric and Magnetic Powders," IEEE Trans. on Components, Packaging, and Manufacturing, Vol. PP, Issue 99, pp. 1-7, 2018.
25. Stephen M. Kuebler, Rashi Sharma, Jennefir L. Digaum, Noel Martinez, Cesar L. Valle, and Raymond C. Rumpf, "Nanophotonic Devices for Three-Dimensional Control of Optical Beams," presented at FiOs, September 2017.
26. Jose A. Avila, Cesar L. Valle, Edgar Bustamante, and Raymond C. Rumpf, "Optimization and Characterization of Negative Uniaxial Metamaterials," PIER C, Vol. 74, pp. 111-121, 2017.
27. Hasanul Karim, Diego Delfin, Luis A. Chavez, Luis Delfin, Ricardo Martinez, Jose Avila, Carlos Rodriguez, Raymond C. Rumpf, Normal Love, and Yirong Lin, "Metamaterial Based Passive Wireless Temperature Sensor" Advanced Engineering Materials 1600741, 2017.
28. Carlos Rodriguez, Jose Avila, Raymond C. Rumpf, "Ultra-Thin 3D Printed All-Dielectric Antenna," PIER C, Vol. 64, pp. 117-123, 2016.
29. Eric A. Berry, Jesus J. Gutierrez, Raymond C. Rumpf, "Design and Simulation of Arbitrarily-Shaped Transformation Optic Devices Using a Simple Finite-Difference Method," PIER B, Vol. 68, pp. 1-16, 2016.

30. R. C. Rumpf, J. J. Pazos, J. L. Digaum, S. M. Kuebler, "Spatially-Variant Periodic Structures in Electromagnetics," Phil. Trans. R. Soc. A, Vol. 373, 2014.0359, July 2015.
31. S. Hwang, E. I. Reyes, K.-S. Moon, R. C. Rumpf, N. S. Kim, "Thermo-mechanical Characterization of Metal/Polymer Composite Filaments and Printer Parameter Study for Fused Deposition Modeling in the 3D Printing Process," JEMS, Vol. 44, No. 3, 2015.
32. J. H. Barton, C. R. Garcia, E. A. Berry, R. Salas, and R. C. Rumpf, "3D Printed All-Dielectric Frequency Selective Surface with Large Bandwidth and Field-of-View," IEEE Transactions on Antennas and Propagation, Vol. 63, No. 3, pp. 1032-1039, March 2015.
33. J. L. Digaum, J. J. Pazos, J. Chiles, J. D'Archangel, G. Padilla, A. Tatulian, R. C. Rumpf, S. Fathpour, G. D. Boreman, and S. M. Kuebler, "Tight Control of Light Beams in Photonic Crystals with Spatially-Variant Lattice Orientation," Optics Express, Vol. 22, Issue 21, pp. 25788-25804, 2014.
34. R. C. Rumpf, C. R. Garcia, E. A. Berry, J. H. Barton, "Finite-Difference Frequency-Domain Algorithm for Modeling Electromagnetic Scattering from General Anisotropic Objects," PIERS B, Vol. 61, pp. 55-67, 2014.
35. J. H. Barton, C. R. Garcia, E. A. Berry, R. G. May, D. T. Gray, R. C. Rumpf, "All-Dielectric Frequency Selective Surface for High Power Microwaves," IEEE Transactions on Antennas and Propagation, 2014.
36. I. R. Srimathi, A. J. Pung, E. G. Johnson, R. C. Rumpf, "Optical Nano-Hairs for Micro-Optical Applications," IEEE Photonic Conference (IPC), pp. 478-479, 2013.
37. R. C. Rumpf, C. R. Garcia, H. H. Tsang, J. E. Padilla, M. D. Irwin, "Electromagnetic Isolation of a Microstrip by Embedding in a Spatially Variant Anisotropic Metamaterial," PIER, Vol. 142, pp. 243-260, 2013.
38. P. I. Deffenbaugh, R. C. Rumpf, K. H. Church, "Broadband Microwave Frequency Characterization of 3-D Printed Materials," IEEE Trans. Components, Packaging, and Manufacturing Technology, Vol. PP, No. 99, 2013.
39. Indumathi R. Srimathi, Aaron J. Pung, Yuan Li, Raymond C. Rumpf, and Eric G. Johnson, "Fabrication of metal-oxide nano-hairs for effective index optical elements," Optics Express, Vol. 21, No. 16, pp. 18733-18741, 2013.
40. C. R. Garcia, R. C. Rumpf, H. H. Tsang, and J. H. Barton, "Effects of extreme surface roughness on 3D printed horn antenna," Electronics Letters, Vol. 49, No. 12, 2013.
41. J. Pazos, R. C. Rumpf, "Optimization of 2D Self-Collimating Photonic Crystals," J. Opt. Soc. Am. A, Vol. 30, No. 7, pp. 1297-1304.
42. R. C. Rumpf, M. Gates, C. L. Kozikowski, W. A. Davis, "Guided-Mode Resonance Filter Compensated to Operate on a Curved Surface," PIER C, Vol. 40, pp. 93-103, 2013.
43. R. C. Rumpf, J. Pazos, C. R. Garcia, L. Ochoa, R. Wicker, "3D Printed Lattices with Spatially Variant Self-Collimation," PIER, Vol. 139, pp. 1-14, 2013.
44. Cesar R. Garcia, Jesus Correa, David Espalin, Jay H. Barton, R. C. Rumpf, Ryan Wicker, Virgilio Gonzalez, "3D Printing of Anisotropic Metamaterials," PIERS Letters, Vol. 34, pp. 75-82, 2012.
45. Jay H. Barton, R. C. Rumpf, R. W. Smith, "All-Dielectric Frequency Selective Surfaces with Few Periods," PIERS B, Vol. 41, pp. 269-283, 2012.
46. R. C. Rumpf, J. Pazos, "Synthesis of Spatially Variant Lattices," Optics Express, Vol. 20, No. 14, pp. 15263-15274, 2012.
47. Jay H. Barton, R. C. Rumpf, R. W. Smith, "All-Dielectric Frequency Selective Surfaces for High Power Microwave Systems," presented at DEPS, April 2012.
48. Z. A Roth, P. Srinivasan, M. K. Poutous, A. J. Pung, R. C. Rumpf, E. G. Johnson, "Azimuthally Varying Guided Mode Resonance Filters," Micromachines 3, 180-193 (2012).
49. R. C. Rumpf, "Simple implementation of arbitrarily shaped total-field/scattered-field regions in finite-difference frequency-domain," PIERS B, Vol. 36, 221-248, 2012.
50. R. C. Rumpf, "Improved formulation of scattering matrices for semi-analytical methods that is consistent with convention," PIERS B, Vol. 35, 241-261, 2011.
51. H. E. Williams, D. J. Freppon, S. M. Kuebler, R. C. Rumpf, and M. A. Melino, "Fabrication of three-dimensional micro-photonic structures on the tip of optical fibers using SU-8," Opt. Express 19, 22910-22922, 2011.
52. Aaron J. Pung, Menelaos K. Poutous, Raymond C. Rumpf, Zachary A. Roth, and Eric G. Johnson, "Two-dimensional guided mode resonance filters fabricated in a uniform low-index material system," Opt. Lett. 36, 3293-3295 (2011).
53. Pradeep Srinivasan, Menelaos K. Poutous, Zachary A. Roth, Yigit O. Yilmaz, Raymond C. Rumpf Eric G. Johnson "Spatial and Spectral Beam Shaping with Space Variant Guided Mode Resonance Filters" Optics Express, Vol. 17, No. 22 , 20365-20375 (Oct. 2009).
54. Pradeep Srinivasan, Yigit O. Yilmaz, Raymond C. Rumpf, and Eric G. Johnson "Micro Optical Spatial and Spectral Elements" Opt. Eng. Vol. 48, 110501 (Nov. 13, 2009).
55. E. Johnson, P Srinivasan, M Poutous, Z Roth, R. Rumpf, "Applications and Engineering of Three-Dimensional Optics," in Frontiers in Optics, OSA Technical Digest (CD) (Optical Society of America, 2009).

56. Alok Mehta, Raymond C. Rumpf, Zachary A. Roth, and Eric G. Johnson, “Erbium-Ytterbium Doped Double Cladding Optical Fiber Laser Utilizing a Guided Mode Resonance Filter as an External Feedback Element,” IEEE Photonics Tech Letters, VOL. 19, NO. 24, pp. 2030-2032 (2007).
57. Raymond C. Rumpf, Alok Mehta, Pradeep Srinivasan, and Eric G. Johnson, “Design and Optimization of space-variant photonic crystal filters,” Applied Optics, Vol. 46, pp. 5755-5761 (2007).
58. A. Tal, Y. Chen, H. E. Williams, R. C. Rumpf, S. M. Kuebler, "Fabrication and characterization of three-dimensional copper metallodielectric photonic crystals," Opt. Express 15, 18283–18293 (2007).
59. Alok Mehta, Jeremiah D. Brown, Pradeep Srinivasan, Raymond C. Rumpf, and Eric G. Johnson, “Spatially Polarizing Auto-Cloned Elements (SPACE)”, Optics Letters, Vol. 32, No. 13, pp. 1935-1937 (2007).
60. Alok Mehta, Raymond Rumpf, and Eric G. Johnson, “Nano-Fabrication of Space Varying Spectral Filters Based on Lattice Constant Variations,” in Computational Optical Sensing and Imaging, CMD-Information and Optics, OSA (2007).
61. A. Mehta, R. C. Rumpf, Z. A. Roth, E. G. Johnson, “Guided Mode Resonance Filter as a Spectrally Selective Feedback Element in a Double-Cladding Optical Fiber Laser,” IEEE Photonic Tech. Lett. 19, 2030–2032 (2007).
62. R. C. Rumpf, M. A. Fiddy, and M. E. Testorf, "Design of generalized invisible scatterers," Opt. Express 15, 4735–4744 (2007).
63. Raymond Rumpf and Eric G. Johnson, “Modeling fabrication to accurately place GMR resonances,” Optics Express, Vol. 15, No. 6, pp. 3452-3464, March 19 (2007) .
64. R. C. Rumpf, A. Tal, S. M. Kuebler, "Rigorous Electromagnetic Analysis of Volumetrically Complex Media Using the Slice Absorption Method," J. Opt. Soc. Am. A 24(10), 3123–3134 (2007).
65. M. A. Fiddy, M. E. Testorf, R. C. Rumpf, “Imaging and Design Based on Nonlinear Filtering of k-Space,” OSA Annual Meeting 2006
66. E. G. Johnson, A. Mehta, R. Rumpf, Z. Roth, and K. Buhl, “Diffractive and Micro-Optics for Spatial, Spectral, and Polarization Modification,” Frontiers in Optics, OSA (2006).
67. Alok Mehta, Raymond Rumpf, and Eric G. Johnson, “Nanofabrication of a space variant optical transmission filter,” Optics Letters, Vol. 31, No. 19, pp. 2903-2905, Oct 2006.
68. Raymond C. Rumpf, Pradeep Srinivasan, and Eric G. Johnson, “Near-Field Nano-Patterning of 3D Structures,” OSA Annual Meeting, Frontiers in Optics, FWS2, Oct 2005.
69. Raymond Rumpf and Eric G. Johnson, “Comprehensive modeling of near-field nano-patterning,” Optics Express, Vol. 13, No. 18, pp. 7198-7208, Aug. 2005 .
70. Raymond C. Rumpf and Eric G. Johnson,” Fully three-dimensional modeling of the fabrication and optical properties of photonic crystals formed by holographic lithography,“ Journal of the Optical Society of America A, Vol. 21, No. 9, pp. 1703-1713, Sept. 2004.

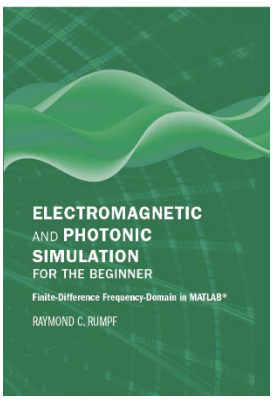
NON-REFEREED PUBLICATIONS & PRESENTATIONS

1. Khorrami, Yaser, et al. "Tunable Guided-mode resonance filter using Spacetime Periodic Structure." 2022 International Conference on Numerical Simulation of Optoelectronic Devices (NUSOD). IEEE, 2022.
2. Raymond C. Rumpf, C. Michael Newton, and Kenneth H. Church, "Printed Circuit Structures: Past, Present and Future," IPC Printed Circuit Structures, Jan 2022.
3. Stephen M. Kuebler, Chun Xia, Rashi Sharma, Jennefir L. Digaum, Noel P. Martinez, Cesar L. Valle, and Raymond C. Rumpf, "Fabrication of functional nanophotonic devices by multiphoton lithography" Proc. SPIE 10915, Organic Photonic Materials and Devices XXI, 1091502 (27 February 2019).
4. Noel P. Martinez, Manuel Martinez, Stephen M. Kuelber, Jimmy E. Touma, Joshua K. Lentz, and Raymond C. Rumpf, "Spatially-Variant Photonic Crystals and Possible Applications" 2018 IEEE Research and Applications of Photonics In Defense Conference (RAPID), Miramar Beach, FL, 2018, pp. 1-4.
5. Jennefir L. Digaum, Rashi Sharma, Daniel Batista, Javier J. Pazos, Raymond C. Rumpf, Stephen M. Kuebler, "Beam-bending in spatially variant photonic crystals at telecommunications wavelengths," Proc. SPIE 9759, 2016.
6. Jennefir L. Digaum, Javier Pazos, Raymond C. Rumpf, Jeff Chiles, Sasan Fathpour, Jeremy N. Thomax, Stephen M. Kuebler, "Polarization sensitive beam bending using a spatially variant photonic crystal" Proc. SPIE 9371, 2015.
7. Chavez, L. A., Delfin, D., Karim, H., Romero, J., Enriquez, R., Rumpf, R., Lin, Y., "Wireless, passive temperature sensor based on frequency selective surfaces for harsh environment applications" submitted to COURI (Campus Office for Undergraduate Research Initiatives) Symposium, 2015.
8. Delfin D., Karim, H., Chavez, L. A., Romero, J. A., Enriquez, R. E., Martinez, R., Sarker R., Shuvo, M. A. I., Rumpf, R. C., Lin, Y., "A passive wireless temperature sensor for harsh environment applications based on frequency selective surface structures" submitted to Southwest Energy Science and Engineering Symposium (SESES), 2015.
9. Raymond. C. Rumpf, "Spatially Variant Structures in Electromagnetics" presented at the Royal Society Meeting on Spatial Transforms, Jan. 2015.

10. H. Karim, M. A. I. Shuvo, D. Delfin, Y. Lin, A. Choudhuri, R. C. Rumpf, "Development of metamaterial based low cost passive wireless temperature sensor," Proc. SPIE 9061, 2014.
11. J. Quintana, R. C. Rumpf, V. Gonzalez, "Modified transfer matrix method model for a fiber Bragg grating strain sensor in polarization maintaining single mode optical fiber," Proc. SPIE 8988, 2014.
12. K. H. Church, H. Tsang, R. Rodriguez, P. Deffenbaugh, R. C. Rumpf, "Printed Circuit Structures, the Evolution of Printed Circuit Boards," Proc. IPC Apex EXPO., Feb. 2013.
13. Aaron J. Pung, Menelaos K. Poutous, Raymond C. Rumpf, Zachary A. Roth, Eric G. Johnson, "Fabrication of optical monolithic, low-index guided mode resonance filters," Proc. SPIE. 8249, Advanced Fabrication Technologies for Micro/Nano Optics and Photonics V 82490F (February 9, 2012).
14. O. R. Bilal, Q. Guo, R. C. Rumpf, M. I. Hussein, "Ultrafast Band Structure Calculation for Photonic Crystals and Metamaterials," presented at PECS-X 10th Int. Symposium on Photonic and Electromagnetic Crystal Structures, Sante Fe, New Mexico, June 2012.
15. Jay H. Barton, R. C. Rumpf, R. W. Smith, "All-Dielectric Frequency Selective Surfaces for High Power Microwave Systems," presented at DEPS, April 2012.
16. Menelaos K. Poutous, Zach Roth, Kaia Buhl, Aaron Pung, Raymond C. Rumpf, and Eric G. Johnson, "Correlation of fabrication tolerances with the performance of guided-mode-resonance micro-optical components," Proc. SPIE 7205, 72050Y (2009)
17. Kaia Buhl, Zachary Roth, Pradeep Srinivasan, Raymond Rumpf, and Eric Johnson "Biologically inspired optics: analog semiconductor model of the beetle exoskeleton," Proc. SPIE 7057, 705707 (2008)
18. Alok Mehta, Raymond Rumpf, and Eric G. Johnson, "Simplified Fabrication Process of 3-D Photonic Crystal Optical Transmission Filter," in Micromachining Technology for Micro-optics and Nano-optics V, SPIE Vol. 6462, 64621D-1 (2007).
19. Raymond Rumpf and Eric G. Johnson, "Modeling the fabrication of nano-optical structures," in Micromachining Technology for Micro-Optics and Nano-Optics IV, SPIE 6110 (2006). (Best Paper Award)
20. P. Srinivasan, R. C. Rumpf, and E. G. Johnson, "Fabrication of 3D Photonic Crystals by two-step dry etching of layered media," in Micromachining Technology for Micro-Optics and Nano-Optics IV, SPIE 6110 (2006).
21. R. C. Rumpf, E. G. Johnson, "Numerical Modeling of 3D Nanofabrication," presented at Micro and Nano-Optics, Optics in the Southeast, June 2006 (Invited Paper).
22. Raymond Rumpf and Eric G. Johnson, "Modeling the formation of photonic crystals by holographic lithography," in Micromachining Technology for Micro-Optics and Nano-Optics III, SPIE 5720 (2005).
23. Raymond C. Rumpf and Eric G. Johnson, "Microphotonic systems utilizing SU-8," in MOEMS and Miniaturized Systems IV, SPIE 5346, 64-72 (2004).
24. R. C. Rumpf, A. Mehta, E. G. Johnson, "An investigation of SU-8 for waveguiding and passive alignment structures in micro-photonic applications," OSA Annual, Photonics Poster, September 2002.

BOOKS & BOOK CHAPTERS

1. Raymond C. Rumpf, *Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB*, Artech House, January 2022.
BEST SELLER
2. Sharma, Rashi, Stephen M. Kuebler, Christopher N. Grabill, Jennefir L. Digaum, Nicholas R. Kosan, Alexander R. Cockerham, Noel Martinez, and Raymond C. Rumpf. "Fabrication of Functional Nanophotonic Devices via Multiphoton Polymerization." Polymer-Based Additive Manufacturing: Recent Developments (2019): 151-171.
3. R. C. Rumpf, "Engineering the Dispersion and Anisotropy of Periodic Electromagnetic Structures," Solid State Physics, Vol. 66, pp. 213-300, 2015.
4. S. Hwang, E. I. Reyes, N. S. Kim, K. S. Moon, and Raymond C. Rumpf. "Parameter study of Fused Deposition Modeling process on thermo-mechanical properties of the final 3D structures made by metal/polymer composite filaments." Biotechnology, Agriculture, Environment and Energy. CRC Press, 2014. 361-366.



UNITED STATES PATENTS, TRADEMARKS & COPYRIGHTS

1. Gilbert Carranza, Raymond C. Rumpf, Christopher Curtis, Christopher Stricklan, "Systems and Methods for Predictive Tool Path Planning for Additive Manufacturing of Functionally Graded Materials," PCT, 2023.
2. Raymond C. Rumpf, Cesar Valle, Gilbert Carranza, "Conformal Frequency Selective Surfaces for Arbitrary Curvature," US Patent 17/934,717, 2023.
3. OMNISLICE, Registered Trademark, 97/562,516, 2022.

4. EMPOSSIBLE, Registered Trademark, 97/510,127, 2022.
5. Raymond C. Rumpf, Cesar L. Valle, Gilbert Carranza, and Ubaldo Robles, "3D Volumetric Circuits and Associated Methods," US Patent 16/678,557, April 2020.
6. Raymond C. Rumpf, Stephen Kuebler, Noel P. Martinez, Cesar L. Valle, "Spatially Variant Photonic Crystal Apparatus, Methods, and Applications," US Patent 10,824,045. November 3, 2020.
7. R. C. Rumpf, C. R. Garcia, "Anisotropic Metamaterials for Electromagnetic Compatibility," U.S. Patent No. 9768515, September 19, 2017.
8. R. C. Rumpf, "Systems and methods incorporating spatially-variant anisotropic metamaterials for electromagnetic compatibility," PCT No. 15/572929, May 2018.
9. R. C. Rumpf, J. C. Coggin, D. Kominksy "Diffractive optical appliqués for measurement of full field strain," US Provisional Patent Application, June 2009.
10. R. C. Rumpf, J. C. Coggin, "Ultra-high temperature wireless sensors," US Provisional Patent Application, March 2009.
11. J. Coggin, R. C. Rumpf, "Fiber Optic Displacement Interrogator," US Provisional Patent Application, March 2008.
12. R. C. Rumpf, Eric G. Johnson, "Communication System Providing Hybrid Optical/Wireless Communications and Related Methods," US Patent 8050244, November 1, 2011.
13. R. C. Rumpf, Eric G. Johnson, "Communication System Providing Hybrid Optical/Wireless Communications and Related Methods," US Patent 7583642, September 1, 2009.
14. C. M. Newton, R. C. Rumpf, C. Gamlen, "Ceramic microelectromechanical structure," US Patent 7035591, April 25, 2006.
15. R. T. Pike, C. M. Newton, C. Gamlen, R. C. Rumpf, "Method for Making Electronic Devices Including Silicon and LTCC and Devices Produced Thereby," US Patent 6987033, January 17, 2006.
16. S. R. Snyder, S. B. Brown, R. C. Rumpf, B. Pigon, J. J. Rawnick, "RF Delay Lines With Variable Composition Fluidic Dielectric," US Patent 6930568, August 16, 2005.
17. R. C. Rumpf, S. H. Murshid, "Fiber Optic Fabry-Perot Interferometer and Associated Methods," US Patent 6886365, May 3, 2005.
18. R. C. Rumpf, W. D. Killen, R. T. Pike, "Substrate Enhancement for Improved Signal Characteristics on a Discontinuous Transmission Line," US Patent 6825743, November 30, 2004.
19. R. T. Pike, C. M. Newton, C. Gamlen, R. C. Rumpf, "Method For Making Electronic Devices Including Silicon and LTCC and Devices Produced Thereby," US Patent 6809424, October 26, 2004.
20. C. M. Newton, R. C. Rumpf, C. Gamlen, "Ceramic Microelectromechanical Structure," US Patent 6738600, May 18, 2004.
21. R. C. Rumpf, C. M. Newton, "MEMS Reconfigurable Optical Grating," US Patent 6628851, September 30, 2003.
22. R. C. Rumpf, C. M. Newton, "Variable Sensitivity Acoustic Transducer," US Patent 6542244, April 1, 2003.
23. B. R. Smith, R. C. Rumpf, C. M. Newton, "Electronic Module Including a Cooling Substrate Having a Fluid Cooling Circuit Therein and Related Methods," US Patent 6452798, September 17, 2002.
24. C. M. Newton, C. A. Gamlen, R. C. Rumpf, "Thermally Enhanced Microcircuit Package and Method of Forming Same," US Patent 6437981, August 20, 2002.

THESES AND DISSERTATIONS SUPERVISED

Ph.D. Dissertations

1. Cesar L. Valle, "Pioneering Concepts for 3D Electromagnetics," Ph.D. Dissertation, University of Texas at El Paso, December 2022.
2. Gilbert T. Carranza, "Processes and Toolchain for Automation of Hybrid Direct-Write 3D Printing," Ph.D. Dissertation, University of Texas at El Paso, December 2022.
3. Jesus J. Gutierrez, "Independent and Simultaneous Control of Electromagnetic Wave Properties in Self-Collimating Photonic Crystals Using Spatial Variance," Ph.D. Dissertation, University of Texas at El Paso, April 2020.
4. Ubaldo Robles, "Hybrid 3D Printing Demonstrated by Arbitrary 3D Meandering Transmission Lines," Ph.D. Dissertation, University of Texas at El Paso, December 2018.
5. Harvey Tsang, "Digital Processes and Characterization for Fabricating 3D RF Devices," Ph.D. Dissertation, University of Texas at El Paso, December 2016.
6. Eric A. Berry, "A Spatially Variant Metamaterial Design Process for Transformation Electromagnetic Devices," Ph.D. Dissertation, University of Texas at El Paso, December 2016.
7. Javier J. Pazos, "Digitally Manufactured Spatially Variant Photonic Crystals," Ph.D. Dissertation, University of Texas at El Paso, December 2014.

8. Paul Deffenbaugh, "3D Printed Electromagnetic Transmission and Electronic Structures Fabricated on a Single Platform Using Advanced Process Integration Techniques," Ph.D. Dissertation, University of Texas at El Paso, August 2014.
9. Jay H. Barton, "Frequency Selective Surfaces for Extreme Applications," Ph.D. Dissertation, University of Texas at El Paso, May 2014.
10. Cesar R. Garcia, "3D Printed Spatially Variant Anisotropic Metamaterials," Ph.D. Dissertation, University of Texas at El Paso, May 2014. BEST DISSERTATION COLLEGE OF ENGINEERING

M.S. Theses

1. Jennifer A. Chavez, “Physics Informed Generative AI for 3D Printed Volumetric Antenna Design and Optimization,” M.S. Thesis, University of Texas at El Paso, May 2025.
2. Asad Gulib, “Numerical Calculation of Spatially Variant Anisotropic Metamaterials,” M.S. Thesis, University of Texas at El Paso, December 2016. BEST MS THESIS IN COMPUTATIONAL SCIENCE PROGRAM.
3. Jose A. Avila, "Dielectric Prism Antenna," M.S. Thesis, University of Texas at El Paso, May 2016.
4. Jose Luis Enriquez, Jr., "Development of Rigorous Electromagnetic Simulation Tools for Anisotropic Structures," M.S. Thesis, University of Texas at El Paso, May 2015.
5. Ubaldo Robles, "3D Printed Impedance Elements by Micro-Dispensing," M.S. Thesis, University of Texas at El Paso, 2013.
6. Ricardo Rodriguez, "Characterization of Direct Print Additive Manufacturing Process for 3D Build of a Carbon Nanostructure Composite," M.S. Thesis, University of Texas at El Paso, August 2014.