

Rick Sturdivant
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Education

Ph.D. (Systems Engineering) Colorado State University
M.A. (Science and Religion) Biola University
M.S. (Electrical Engineering) University of California, Los Angeles
B.S. (Electrical Engineering) California State University, Long Beach
B.A. (Religion) Vanguard University

Summary Of Experience

Dr. Sturdivant has 28 years of experience as an engineer developing solutions for microwave and millimeter-wave systems, electronic packaging, components such as filters and integrated circuits, and subsystems such as down converters and digital receivers. He has started several technology companies and has worked at major defense contractors. He has been awarded seven U.S. patents, authored or edited four books, has written several book chapters, and has published many articles, conference papers, and workshops in the field of engineering. He is a Senior Member of the IEEE, serves on one of its technical subcommittees, and regularly reviews journal articles and conference papers for several IEEE societies. He is also an Assistant Professor at Azusa Pacific University.

Professional Experience

Azusa Pacific University, 2016-Present, Job Title: Assistant Professor

- Instructor for systems engineering, mechanics, dynamics, and electric circuits
- Research in systems engineering, green power, manufacturing, and radar/com systems

Georgia Tech Research Institute, 2010-2013

- Gave lectures as part of an engineering short course

MPT, Inc. 2003-Present, Job Title: Founder & Chief Technology Officer

- Boot strapped MPT from zero income into a multi-million dollar a year company
- Developed T/R modules for phased array radar using surface mount (SMT) techniques

Multilink Technology, Inc. 2000-2003, Job Title: Technical Product Manager

- Helped grow Multilink to its successful Initial Public Offering (IPO)
- Designed high linearity driver and HPA MMIC with 30KHz to 20GHz BW
- Product development lead for new products which resulted in \$33M income per year
- Developed world's first BGA surface mount 12.5Gb/S Modulator Driver product
- Designed lumped element and distributed filters for duo-binary systems

Raytheon (Hughes Aircraft Company), 1989-2000, Job Title: Senior Staff Engineer

- Designed MMIC amplifiers, phase shifters, low noise amplifiers and switches
- Designed T/R modules for airborne radar applications at X-Band
- Design MMIC doubler (12GHz), tripler (33GHz), and LNA (40GHz) for point to point
- Developed world's first tile array module, received Engineering Excellence Award

List of Publications

Books

1) K. Kuang, R. Sturdivant, editors, *RF and Microwave Microelectronics Packaging II* (New York, NY: Springer Publishing, 2017).

- 2) R. Sturdivant, M. Harris, *Transmit/Receive Modules for Communication and Radar Systems* (Norwood, MA: Artech House, 2015).
- 3) R. Sturdivant, A.J. Bogdon, *Hands on Guide to Heat Transfer For Microwave and Millimeter-wave Electronics* (eBook published by Amazon, 2015).
- 4) R. Sturdivant, *Microwave and Millimeter-wave Electronic Packaging* (Norwood, MA: Artech House, 2014).

Book Chapters

- 1) R. Sturdivant, "Fundamentals Of Packaging at Microwave and Millimeter-wave Frequencies," Chapter 1 in *RF and Microwave Microelectronic Packaging* (New York: Springer Publishing, 2010).
- 2) R. Sturdivant, "Introduction to RF and Microwave Microelectronic Packaging," Chapter 1 in *RF and Microwave Microelectronic Packaging II* (New York: Springer Publishing, 2017).
- 3) R. Sturdivant, "Packaging of Transmit/Receive Modules," Chapter 2 in *RF and Microwave Microelectronic Packaging II* (New York: Springer Publishing, 2017).
- 4) R. Sturdivant, "3D Transitions and Connections," Chapter 3 in *RF and Microwave Microelectronic Packaging II* (New York: Springer Publishing, 2017).

Articles, Conference Papers, Workshops, and other Publications

- 1) R. Sturdivant, A Wide Band, Low Loss, Miniature Microwave Diplexer, M.S. Thesis, Dept. Elect. Eng., University of California at Los Angeles, Los Angeles, CA, 1992.
- 2) R. Sturdivant, "Balun Designs For Wireless ... Mixers, Amplifiers and Antennas," *Applied Microwave and Wireless*, Summer 1993.
- 3) R. Sturdivant, "A Capacitively Coupled BPF Design Using a Suspended Substrate Stripline," *Microwave Journal*, Nov. 1993, pp 71-74.
- 4) R. Sturdivant, C. Quan, B. Young, "Using the matrix metal-on-elastomer connector at microwave frequencies," presented at *International Symposium on Microelectronics*, 27 th, Boston, MA. 1994.
- 5) R. Sturdivant, T. Theisen, "Heat Dissipating Transmission Lines," *Applied Microwave & Wireless*, Spring 1995, pp. 57-63.
- 6) R. Sturdivant, "Transmission Line Conductor Loss and the Incremental Inductance Rule," *Microwave Journal*, Sept. 1995.
- 7) R. Sturdivant, "Millimeter-wave characterization of several substrate materials for automotive applications," presented at *Electrical Performance of Electronic Packaging*, 1995, pp. 137-139.
- 8) R. Sturdivant, "Reducing the effects of the mounting substrate on the performance of GaAs MMIC flip chips," in *IEEE MTT-S International Microwave Symposium Digest*, 1995, pp. 1591-1595.
- 9) Midford, T., Wooldridge, J., Sturdivant, R., "The evolution of packages for monolithic microwave and millimeter-wave circuits," *IEEE Transactions on Antennas and Prop.*, Vol 43, No. 9, 1995, pp. 983-991.
- 10) R. Sturdivant, et. al., "Transitions and interconnects using coplanar waveguide and other three conductor transmission lines," in *IEEE MTT-S International Symposium Microwave Digest*, May 1996.

- 11) R. Sturdivant, et. al., "Design and Performance of a High Density 3D Microwave Module," in *IEEE MTT-S International Symposium Digest*, 1997, pp. 501-504.
- 12) R. Sturdivant, et. al., "Using MMIC flip chips and CVD diamond for improved thermal management of microwave modules," in *IEEE MTT-S International Microwave Symposium Digest*, 1997, pp. 505-507.
- 13) R. Sturdivant, "MCMs, 3D Packaging, Wafer Scale Packaging, Plastic Packaging," WMA Workshop, in *IEEE MTT-S International Microwave Symposium*, Baltimore, MD June 1998.
- 14) C.P. Schaffer, I.C. Chen, R.L. Sturdivant, et. al., "Commercial CVD diamond films: Material properties and their related effects on microwave characteristics," *Diamond and Related Materials*, vol. 7, Feb. 1999, pp. 585-588.
- 15) R. Sturdivant, 'Investigation of MMIC flip chips with sealants for improved reliability without hermeticity,' in *IEEE MTT-S International Microwave Symposium Digest*, 1996, pp. 239-242.
- 16) R. Sturdivant, G.E. Ponchack, "PWB Workshop: Should I choose a ceramic or organic board?" in *IEEE International Microwave Symposium Digest*, Fort Worth, TX, June 2004.
- 17) R. Sturdivant, "WSJ Workshop Presentation: Ceramic Packaging Issues for Wireless High Power Amplifiers," in *IEEE International Microwave Symposium Digest*, Fort Worth, TX, June 2004.
- 18) R. Sturdivant, 'Millimeter-wave Performance of Alumina High Temperature Cofired Ceramics IC Packages,' presented at *IMAPS 2006 International Conference and Exhibition on Device Packaging*.
- 19) R. Sturdivant, 'Microwave Performance of Ball Grid Array Packages,' presented at *IMAPS 2006 International Conference and Exhibition on Device Packaging*.
- 20) R. Sturdivant, "Millimeter-wave Radio System In A Package," presented at *IMAPS Advanced Technology Workshop on RF and Microwave Packaging*, Sept. 2008
- 21) R. Sturdivant, "Design of Transmit/Receive Modules", presented at *IMAPS Advanced Technology Workshop on RF and Microwave Packaging*, Sept. 2009
- 22) R. Sturdivant, "The Incompatibility of Emergent and Thomistic Views of the Soul," Student Paper, presented at *59th Annual Midwest Regional Evangelical Theological Society Meeting*, 2014.
- 23) R. Sturdivant, 'Broadband Electrical Modeling of Transitions and Interconnects Useful for PCB and Co-fired Ceramic Packaging,' presented at *2014 IMAPS RaMP Conference*, San Diego, CA. Winner of best session paper award.
- 24) R. Sturdivant, "Materials and Transmission Line Measurements Comparing HTCC and Thick Film Alumina," presented at *2014 IMAPS RaMP Conference*, Diego, CA
- 25) R. Sturdivant, "How to Successfully Measure and Model Electronic Packages for SI" WMJ Workshop, in *IEEE MTT-S International Microwave Symposium Digest*, Phoenix, AZ, May 2015.
- 26) R. Sturdivant, "Electronic Packaging at Microwave and Millimeter-wave Frequencies: Applications, Key Components, and Design Issues", presented at *IEEE CLASTECH Conference*, Los Angeles, 2015.
- 27) R. Sturdivant, E.K.P. Chong, "Modeling and Simulation of Via Conductor Losses in Co-fired Ceramic Substrates Used In Transmit/Receive Radar Modules," presented at *2016 IMAPS RaMP Conference*, San Diego, CA.

- 28) R. Sturdivant, E.K.P. Chong, "Systems Engineering Of Hybrid Renewable Electric Power," in *IEEE Green Tech Conference*, Kansas City, MO, April 7-8, 2016
- 29) R. Sturdivant, E.K.P. Chong, "Systems Engineering Contributions To Digital Receivers For Phased Array Radar," in *2016 IEEE International Symposium on Phased Array Systems and Technology*, Oct. 18-21, Waltham, MA.
- 30) R. Sturdivant, A.J. Bogdon, E.K.P. Chong, "A simple closed form solution to single layer heat spreading angle appropriate for microwave hybrid modules," *Journal of Electronics Cooling and Thermal Control*, June 2016, no. 6, pp.52-61.
- 31) R. Sturdivant, E.K.P. Chong, "Systems engineering of low cost AESAs for high volume consumer LEO satellite ground stations," presented at *Ka and Broadband Communications Conference*, Cleveland, OH, Oct. 2016.
- 32) R. Sturdivant and E. K. P. Chong, "Systems engineering of a terabit elliptic orbit satellite and phased array ground station for IoT connectivity and consumer Internet access," *IEEE Access*, Vol. PP, No. 99, Sept. 13, 2016.
- 33) R. Sturdivant, L. Miller, E.K.P. Chong, "Systems Engineering Of Digitally Beam Formed Electronically Scanned Phased Arrays for Terabit per Second Satellites," in *IEEE Topical Workshop On The Internet of Space (IoT)*, Phoenix, AZ, January 15-18, 2017.
- 34) R. Sturdivant, E.K.P. Chong, "Dielectric Notch Radiator Antennas with Integrated Filtering For 5G and IoT Access," in *IEEE Radio and Wireless Symposium*, Phoenix, AZ, January 15-18, 2017.
- 35) R. Sturdivant, E.K.P. Chong, "System Latency Performance of Mechanical and Electronic Scanned Antennas for LEO Ground Stations for IoT and Internet Access," in *IEEE Topical Workshop On The Internet of Space (IoT)*, Phoenix, AZ, January 15-18, 2017.
- 36) A. Zahnd, M. Stambaugh, D. Jackson, T. Gross, C. Hugi, R. Sturdivant, J. Yeh, S. Sharma, "Modular Pico-Hydro Power System for Remote Himalayan Villages," in *World Renewable Energy Congress XVI*, Feb 5-9, 2017, to appear.
- 37) R. Sturdivant, J. Yeh, M. Stambaugh, A. Zahnd, E. K. P. Chong, "Pico-hydro electric power in the Nepal Himalayas," in *Proceedings of the 9th IEEE Annual Green Technologies Conference (IEEE GreenTech 2017)*, Denver, Colorado, March 29–31, 2017, to appear.
- 38) R. Sturdivant, A. Bogdon, E.K.P. Chong, "Balancing Thermal and Electrical Packaging Requirements for GaN Microwave and Millimeter-Wave High Power Amplifier Modules," *Journal of Electronics Cooling and Thermal Control*, Vol. 7, No. 1, 2017, pp. 1-7.
- 39) R. Sturdivant, "Systems Engineering Baseline Concept Of A MultiSpectral Drone Detection Solution For Airports," *IEEE Access*, Vol. PP, Vol. 99, April 25, 2017.
- 40) R. Sturdivant, "The Reflective Reciprocal Support Model for Integration of Science and Christianity," *Southern California Christians in Science Conference*, Riverside, CA, April 8, 2017.
- 41) R. Sturdivant, "Systems Engineering Baseline Concept Of A Multi Spectral Drone Detection Solution For Airports," *IEEE Access*, Vol. PP, No. 99, April 25, 2017.

42) R. Sturdivant and E. K. P. Chong, “Smart base stations for IoT,” presented at *Cyber Cycles for the Internet of Things (IoT)*, workshop at *1st IEEE Conference on Control Technology and Applications (CCTA)*, Kohala Coast, Hawai’i, August 27–30, 2017.(to appear)

Awarded Patents

5,886,587 Flipped lumped element circulator

5,691,566 Tapered three-wire line vertical connections

5,689,216 Direct three-wire to stripline connection

5,675,302 Microwave compression interconnect using dielectric filled three-wire line...

5,552,752 Microwave vertical interconnect through circuit with compressible conductor

8,594,638 Dynamic wireless networks and interactive wireless information communication ...

9,277,643 S-shaped ceramic feedthrough

Other Professional Experience

Dr. Sturdivant is a recognized expert in the field of T/R modules, phased arrays, and electronic packaging. He has specialized training in systems engineering and applied electromagnetics. He is a member and past chair of the IEEE MTT-12 Technical Subcommittee on microwave and millimeter-wave packaging. He is also one of the speaker bureau lecturers for that committee. He has been an invited speaker to IEEE local chapters such as the local MTT-S chapter in San Diego, CA and the joint MTT-S and AP-S in Baltimore, MD.

Abbreviated List of Accomplishments

IEEE MTT-S Speakers Bureau 2011-2017

Invited Speaker: IEEE MTT-S, APS Baltimore Section, 2009

Invited Speaker: IMAPS San Diego Chapter, November 15, 2011

Invited Speaker: IEEE MTT-S Buena Ventura Section, March 2013

Invited Speaker: Georgia Tech Professional Education, 2011, 2012, 2013

Invited Speaker: IEEE CLASTECH Symposium, 2015

Recipient of Hughes Microwave Masters Fellowship

Awarded Hughes Aircraft Company Engineering Excellence (Engineer of the Year) Award

Guest Editor: IEEE Transaction Microwave Theory and Techniques, Vol. 45, No. 10, 1997

Member IEEE MTT-S MTT-12 Technical Subcommittee on Packaging and Manufacturing

Past Chair IEEE MTT-S MTT-12 Technical Subcommittee on Packaging and Manufacturing

Workshop Organizer: PWB Session, IEEE Int. Microwave Sym. 2004

Workshop Organizer: WSC Session, IEEE Int. Microwave Sym. 1998

Member Steering Committee, IEEE International Microwave Symposium, San Diego, 1994

Principle Investigator, MDA SBIR Phase II, HQ0147-17-C-7302, Digital Receiver, Nov. 2016

Principle Investigator, Army SBIR Phase III, W911W6-14-C-0014, Low Cost Radar, 2014

Principle Investigator, Navy SBIR Phase II, N00024-13-C-4524, GaN Limiters, 2013

Principle Investigator, Army SBIR Phase II, W31P4Q-13-C-0021, Low Cost Radar, 2013

Principle Investigator, Army SBIR Phase I, W31P4Q-12-C-0011, Low Cost Radar, 2012

Principle Investigator, Navy SBIR Phase I, N00167-11-P-0382, GaN Limiters, 2011

Principle Investigator, Navy SBIR Phase II, N68335-10-C-0050, W-Band Amplifier, 2010

Principle Investigator, Navy SBIR Phase I, N68335-08-C-0467, W-Band Amplifier, 2008

Principle Investigator, MDA SBIR Phase II, HQ0006-06-C-7324, Innovative Radar, 2006

Principle Investigator, Air Force SBIR Phase II, FA9453-05-M-0085, ESA T/R Module, 2005

Principle Investigator, MDA SBIR Phase I, HQ0006-05-C-7189, Manufacturing, 2005

Principle Investigator, MDA SBIR Phase I, N00164-04-C-6039, Power Amplifier, 2004

Principle Investigator, MDA SBIR Phase I, W9113M-04-P-0048, Innovative Radar, 2004