Todor Cooklev, PhD.

Curriculum Vitae

Personal

1336 Sycamore Hills Parkway, Fort Wayne, IN 46814
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Cell: 925-984-5283

Citizenship: United States (by naturalization)

Professional experience

2016 – **Professor of Electrical and Computer Engineering**
2101 E Coliseum Blvd., ETCS 349
Purdue University Fort Wayne, Indiana 46805

- Research on most aspects of wireless systems, including hardware, signal processing, and software techniques, in particular for software-defined radios.
- Courses:
  ECE 428 Communication Systems
  ECE 549 Software-Defined Radio
  ECE 543 Wireless Communications and Networks

2013 – 2017 **Co-founder and CEO, Adaptive RF, Fort Wayne, IN**

- Developed innovative RF technology and served as co-founder of a company that received funding from the Department of Defense

2018 – 2019 **Chief Technology Officer, Stryke Industries LLC**

- CTO in connection with a grant from the Air Force Research Laboratory, Rome, NY

2010 – 2016 **ITT Associate Professor of Wireless Communication and Applied Research,** *Purdue University Fort Wayne*

2008 – 2022 **Director, Wireless Technology Center**
Purdue University Fort Wayne

2005 – 2008 **Consultant, Hitachi America Ltd., San Jose, California**

- Voting Member, IEEE 802.11 WG; participated in the work on several 802.11 amendments
- Chair, IEEE 802.11 VTS Study Group; responsible for the proposal and approval to create a Task Group that lead to the IEEE 802.11aa standard

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2011 – 2012 **Consultant, Hitachi America Ltd., San Jose, California**

- Attended meetings of the 3GPP RAN1 standardization committee in Dresden, Germany, Jeju Island, Korea, Prague, Czech Republic, and Qindao, China, 2012.
- Contributed to several documents submitted to 3GPP

2006 – 2008 **Consultant,** *Datamars, Lugano, Switzerland*

- Evaluated and produced reports on certain wireless technologies and standards
- Participated in the IEEE 802.15.4f committee

2004 – 2006 **Consultant,** *Leica Geosystems, Switzerland*

- IEEE 802.16 (WiMAX) and related technologies

2005 – 2007 **Technical Advisory Board Member***, Doceotech, San Ramon, CA*

2002 – 2008 **Assistant Professor** with tenure (2008), *San Francisco State University.*

2000 – 2002 **Member of the Technical Staff***, Aware, Inc., Bedford, MA and Lafayette, CA*

- Worked on DSL standards. Participated in the International Telecommunications Union, Study Group 15, Question 4. Chaired the session on coding for DSL at the session in Antwerp, Belgium, June 2000. Participated in the Telecommunications Industry Association T1E1 Committee on DSL
- Developed advanced coding and decoding methods for DSL
- Worked on the design of an IEEE 802.11a chipset.
- Voting member, IEEE 802.15; Co-Founder and First Vice-Chair of IEEE 802.15.3 (High-data rate wireless personal area networking

1998-1999 **Consultant***, Quantronix, Framingham, Utah*

- Image processing; developed software for edge detection and wrote a report

1996-1997 **Consultant,** *Communications Research Center, Government of Canada.*

- Designed digital filter banks for communication systems and wrote two technical reports

1996-1999 **Senior Engineer,** *3Com Corporation*

- Worked on V.90 voice-band modems
- Implemented data compression and other signal processing algorithms V.42 and V.42bis
- Worked on the Bluetooth Standard, one of the first contributors to the Host Controller Interface of Bluetooth.
- Participated in the Bluetooth/IEEE group, which drafted the license agreement between Bluetooth and the IEEE 802, which in turn led to the establishment of the IEEE 802.15 Working Group.

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Grants Awarded

1. Office of Naval Research Summer Fellow 2020, Naval Surface Warfare Center Crane

2. National Science Foundation S^2ERC I/UCRC, "FPGA implementation of shared-memory middleware", 2017-2019, PI

3. National Science Foundation S^2ERC I/UCRC, "Shared-memory middleware", 2016-2017, PI

4. City of Fort Wayne, Economic Development Fund, 2013-15, co-PI.

5. Allen County Capital Improvement Board (CIB), 2013-15, co-PI

6. U.S. Defense Advanced Research Projects Agency (DARPA) Small Business Technology Transfer (STTR) Phase I "A flexible and extensible solution to incorporating new RF devices and capabilities into EW/ISR networks, co-PI, August 2013 – February 2014.

7. National Science Foundation S^2ERC I/UCRC, "The performance of middleware solutions for SDR", 2013-2014, PI

8. National Science Foundation S^2ERC I/UCRC, "Cognitive decision applications for embedded use," 2011-2012, PI

9. Visiting Fellowship, National Institute of Communication Technology (Japan), 2011

10. National Science Foundation S^2ERC I/UCRC, "Signal processing techniques for multicarrier modulation," 2009-2011, PI

11. NMDG, Belgium, laboratory grant 2010, PI

12. National Science Foundation, Professional Science Master's Program, MS in engineering, with concentration in wireless and systems engineering, 2010-2013, Co-PI.

13. Emona Instruments, Sydney, Australia, Laboratory exercises in communications, Principal Investigator, 2008.

14. Lilly Endowment, wireless laboratory grant, 2010, PI.

15. ITT (now Harris) Communications Systems, 2007-2011, PI.

16. State of Indiana, workforce development, 2008-2010, PI

17. National Science Foundation DUE-0442313, "Standards in Education for Product, Process, and Service Design and Development: A Proof-of-Concept Project," 2005-2008, PI.

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18. France Telecom, Paris, France, "New methods for multicarrier modulation for high data-rate wireless systems," Principal Investigator, 2006.

19. Agilent Technologies/Sun Microsystems, Palo Alto, CA, "Distributed wireless sensor network for environmental monitoring," Co-principal Investigator, 2005.

20. CSU summer research grant, 2004.

21. U.S. Air-Force Research Laboratory, Wright-Patterson AFB, "Data over voice communications," Principal Investigator, 2004.

Honors and Awards

2012	IEEE Standards Association, "for outstanding contributions to the development of IEEE 802.11aa"
2006	Wireless Educator of the Year Award with the citation "In recognition of the pivotal role of educators in preparing tomorrow's wireless technology leaders".
2005	Duke's Choice Award, Sun Microsystems, (group award)
2003	IEEE Communications Society Oakland/East Bay Chapter Achievement Award, (group award)
1999	3Com Inventor Award
1995-1997	NATO Science Fellowship
1994	IEEE Asia - Pacific Conference on Circuits and Systems Best Paper Award for the paper "Theory of filter banks over finite fields"

Education

1995 *Tokyo Institute of Technology, Tokyo, Japan,*
Doctor of Philosophy in Electrical Engineering
Dissertation: Regular Perfect-Reconstruction Filter Banks and Wavelet Bases

1988 *Technical University of Sofia, Bulgaria,* Dipl. Eng. in Electrical Engineering

Professional Activities

Board Membership:
Board of Governors, IEEE Standards Association, 2021-2022

Committee/Editorial Board Membership:
IEEE Communications Standards Magazine, Series Editor, Wireless and Radio Communications, 2017-

Committee Membership:
- IEEE 802.11 Working Group Voting Member, 2001-2003, 2006-present

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- IEEE 802.15 Working Group Voting Member 1999-2001
- Chairman, IEEE Standards in Education Committee, 2006 – present
- Member of the Editorial Board, Journal of Networks.
- 2004-2005 Chairman and 2003-2004 Secretary of the Oakland/East Bay Chapter of the IEEE Communication Society.

Program Committee Membership:

- General Chair, Tactical Communications and Interoperability Conference, 2011
- General Chair, Fort Wayne Wireless Summer School 2009 and 2010
- Program Committee Member, Int. Conf. on Wireless Applications and Computing, 2007.
- Program Committee Member, Int. Conference on WLAN, WPAN, and WMAN, Hawaii, Aug. 2007.
- Program Committee Member, Int. Joint Conf. e-Business and Telecommunications, Barcelona, Spain, 2007.
- Program Committee Member, Int. Conf. Wireless Information Networks and Systems, Lisbon, Portugal, 2006.
- Technical Program Committee Member, Int. Conf. Networking and Services, ICNS 2006, Santa Clara, CA.
- Technical Program Committee Member, Advanced Int. Conference on Telecommunications, AICT, Guadeloupe, French Caribbean 2006.
- Program Committee Member, Int. Joint Conf. e-Business and Telecommunications, Reading, UK, 2005.
- Technical Program Committee Member, Int. Conf. Convergent Services and Next-Generation Networks, June 2005, Chicago, IL.
- Technical Program Committee Member, Int. Conference on Service Assurance with Partial and Intermittent Resources, Lisbon, Portugal, July 2005.
- Technical Program Committee Member, Int. Conf. Telecommunications, 2004, Brazil.
- 3rd Int. Workshop on Signal and Image Processing, Manchester, UK, Special session on wavelets in communication systems, signal and image processing, special session co-organizer, Nov. 1996.

Tutorials at International Conferences

1) T. Cooklev, "The analog RF-digital interface: the VITA 49 standard and evolution roadmap," First IEEE Next G Summit, Johns Hopkins University, June 14, 2022.
2) T. Cooklev, "Open RF-digital interfaces and wireless ontologies," IEEE BlackSeaCom, 4th International Black Sea Conference on Communications and Networking, Varna, Bulgaria, June 2016.
3) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the 2008 Symposium System on Chip, Tampere, Finland, Nov. 2008.
4) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the IASTED Int. Conference Computer Communications, Palma de Mallorca, Spain, Sept. 2008.
5) M. Cummings, T. Cooklev, "Software Defined Radio Technology", Tutorial at the 2007 International Conference on Computer Design, Squaw Creek, CA 2007.
6) T. Cooklev, "Wireless communication standards: 802.11, 802.15, and 802.16," Int. Conference Telecommunications, Fortaleza, Brazil, Aug. 2004, tutorial.
7) T. Cooklev, "Wireless data communication standards, IEEE Globecom 2003, Dec. 2003, San Francisco, CA, tutorial.

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Short Courses and Invited Talks excluding conferences:

1) T. Cooklev, "Open RAN", Technical University of Sofia, Bulgaria, November 2019.
2) T. Cooklev, "Software-defined radio technology," Oulu University, Finland, Oct. 2017.
3) T. Cooklev, "Software-defined radio technology," Aarhus University, Denmark, Oct. 2017.
4) T. Cooklev, "Modern wireless systems," Technical University of Sofia, Bulgaria, 2014.
5) T. Cooklev, "Modern Wireless Systems," Featured faculty presentation, Feb. 2012, IPFW.
6) T. Cooklev, "Software-defined radio technology," Tokyo Institute of Technology, Dec. 2011.
7) T. Cooklev, "Software-defined radio technology," University of Akron, OH, 2010.
8) T. Cooklev, "Modern wireless systems," Catholic University of Leuven, Leuven. Belgium, 2010
9) T. Cooklev, "Modern wireless systems," University of Qatar, Doha, Qatar, 2009.
10) T. Cooklev, "Modern wireless systems," Technical University of Sofia, Bulgaria, 2009.
11) T. Cooklev, "Modern wireless systems: from Marconi's radio to cognitive radio," Sigma Xi presentation, February 2009, IPFW.
12) T. Cooklev "Software-Defined Radio Technology," Talk at IPFW, Oct. 2008.
13) M. Cummings, T. Cooklev, "Software Defined Radio Technology", IEEE Communication Society, Oakland/East Bay Chapter, presentation, Oct. 2007, San Ramon, CA.
14) T. Cooklev, "Engineering Standards in Engineering Education," presentation and a panel participant, Standards Engineering Society Annual Conference, San Francisco, CA, August. 2007. (panelist and presenter)
15) T. Cooklev, "Vector transform for multicarrier modulation", France Telecom, June 2007, Rennes, France.
16) T. Cooklev, "Wireless Communication Standards," Distinguished Lecture, IEEE Communication Society, Oct. 2006, University of Maine.
17) T. Cooklev, "The IEEE 802.11, 802.15, and 802.16 Families of Standards," Short Course, April 2006, Lietuvos Telekomas, Vilnius, Lithuania,
18) T. Cooklev, "The IEEE 802.11, 802.15, and 802.16 Families of Standards," Short Course, Feb. 2006, Austin, TX.
19) T. Cooklev, "The IEEE 802.11, 802.15, and 802.16 Families of Standards," Invited Talk, Dec. 2005, Cisco Systems, San Jose, CA.
20) Wireless local area networks, Hitachi Ltd., Brisbane, CA, June 2005.
21) T. Cooklev, "The IEEE 802.11, 802.15, and 802.16 Families of Standards," Invited Talk, May 2005, Texas Instruments, Dallas, TX.
22) T. Cooklev, "Standards for the Wireless Internet", IEEE Communication Society, Oakland/East Bay Chapter, presentation, January 2005. Freemont, CA.
23) T. Cooklev, "Wireless data communication standards, IEEE Wescon, Aug. 2003, San Francisco, CA, tutorial.
24) Short Course on 802.11, 802.15, 802.16, West Long Branch, NJ, August 2003
25) Wireless data communication standards, Lockheed Palo Alto Research Center, June 5, 2003.
26) Short Course on IEEE 802.11, 802.15, and 802.16, San Francisco, CA, Dec. 2002.
27) Standards for wireless data communications, University of Utah, Salt Lake City, UT, 1999
28) OFDM for wireless communications, 3Com Technology Forum, Boston, MA, Nov. 1998.
29) Filter banks and wavelets: a modern applied mathematics tool, Invited Lecture at the Analysis Day, Department of Mathematics and Statistics, Carleton University, Ottawa, Canada, 1997
30) Filter banks and wavelets for video signal processing, Genesis Microchip Inc, Markham, Ontario, Canada, July 1996.

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31) Advanced topics in filter banks, wavelets, and their applications in modern communications systems, CRC, Ottawa, March and August 1996.
32) Digital filter banks and wavelets, Dept. Elect. Eng., University of Ottawa, March 1996.
33) Digital filter banks and wavelets, Dept. Elect. Eng., Queen's University, Kingston, March 1996.
34) Perfect-reconstruction filter banks and wavelet bases and their applications in digital communications, Fujitsu Laboratories, Kawasaki, Japan, July 1994.
35) Fast algorithms for signal processing, Istanbul University, Istanbul, Turkey, Jan. 1994.

Publications

Books and Monographs

1) T. Cooklev, *Modern Communication Systems: A first course*, University of Michigan Press, 2022 (in preparation).
2) T. Cooklev, W*ireless communications standards: A Study of IEEE 802.11, 802.15, 802.16*, IEEE Press, New York, NY. 2004.

Chapters in Books

1) A. Vlahov, D. Elkova, V. Poulkov, T. Cooklev, Virtualized, open, and intelligent: the evolution of the Radio Access Network," River Publishers, 2021.

2) Subbu Ponnuswamy, Todor Cooklev, Yang Xiao, and Krishna Sumanth Velidi, "Security in fixed and mobile IEEE 802.16 networks," Chapter 4, *WiMAX/MobileFi: Advanced Research and Technology*, edited by Yang Xiao, Taylor and Francis, January 2008.

3) T. Cooklev and A. Hristozov, "The Software Communications Architecture," in *Resource Management in Future Internet*, edited by Ramjee Prasad, River Publishers, Denmark, 2015.

Journal Papers

1) V. Kolev, T. Cooklev, F. Keinert, *Design of a Simple Orthogonal Multiwavelet Filter by Matrix Spectral Factorization*, Circuits, Systems, and Signal Processing, 2019.

2) Y. Acar and T. Cooklev, "High performance OFDM with index modulation", *Physical Communication*, vol. 32, pp. 192-199, 2019.

3) M. Sherman and T. Cooklev, "Abstract descriptions of spectrum: VITA 49 and IEEE 1900.5.2", *IEEE Communications Standards Magazine*, vol. 2, no. 4, pp. 43-48, December 2018.

4) T. Cooklev, V. Poulkov, D. Bennett, K. Tonchev, "Enabling RF data analytics services and applications via cloudification," *IEEE Aerospace Electronic Systems Magazine*, vol. 33, no. 5-6, pp. 44-55, May-June 2018.

5) V. Kolev, T. Cooklev, F. Keinert, "Matrix spectral factorization for the SA4 multiwavelet," *Journal of Multidimensional Systems and Signal Processing*, vol.29, Issue 4, pp 1613–1641, 2018.

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6) H. Dogan, T. Cooklev, and J. Darabi, "Improved low-complexity zero-padded OFDM receivers", *Digital Signal Processing*, vol. 51, pp. 92–100, April 2016.

7) P. Baltiiski, I. Iliev, B. Kehaiov, V. Poulkov, and T. Cooklev, "Long-Term Spectrum Monitoring with Big Data Analysis and Machine Learning for Cloud-Based Radio Access Networks," *Wireless Personal Communications*, vol. 87, issue 3, pp. 815-835, April 2016.

8) T. Cooklev, J. Darabi, C. McIntosh, and M. Mosaheb, "Cloud-based approach for spectrum monitoring," *IEEE Instrumentation and Measurement Magazine*, vol. 18, no. 2, pp. 33-37, April 2015.

9) Sven Bilen, A. Wyglinski, C. Anderson, T. Cooklev, C. Dietrich, B. Farhang-Boroujeny, "On Software-Defined Radio as an integrative educational resource," *IEEE Communications Magazine*, vol. 52, no. 5, pp. 184-193, May 2014.

10) Hakan Yıldız, Yusuf Acar, Todor Cooklev, Hakan Dogan, "Generalized Prefix for Space-Time Block Coded OFDM Wireless Systems over Correlated MIMO Channels," *IET Communications*, vol. 8, no. 9, pp. 1589-1598, June 2014.

11) T. Cooklev, A. Nishihara, "An Open RF-Digital interface for software-defined radios," *IEEE Micro,* vol. 33, no. 6, pp. 47-55, Dec. 2013.

12) T. Cooklev, R. Normoyle, and D. Clendenen, "The VITA 49 RF-digital interface," *IEEE Circuits Systems Magazine*, vol. 12, no. 4, pp. 21-32, Dec. 2012.

13) T. Cooklev, "An improved prefix for OFDM-based cognitive radios", *Electron. Lett.*, vol. 48, No. 4, Feb. 2012.

14) Y. Alqudah and T. Cooklev, "Hands-on open access broadband wireless technology lab", *Int. J. Interactive Mobile Tech.*, Vol. 6, No 4, 2012, pp. 13-18.

15) T. Cooklev, H. Dogan, R. Cintra, H. Yildiz, "Generalized prefix for OFDM wireless systems over quasi-static channels," *IEEE Transactions on Vehicular Technology,* vol. 60, No. 8, pp. 3684 – 3693, *Nov.* 2011.

16) F. Ramirez-Mireles, T. Cooklev, and G. A. Paredes-Orozco, "UWB-FSK: Performance tradeoffs for high-complexity receivers," *IEEE Transactions on Consumer Electronics*, vol. 56, no. 4, pp. 2123-2131, 2010.

17) S. Hossain, D. Batovski, and T. Cooklev, "Eight-channel transmultiplexer with binary matrix sequences," *Assumption Univ. Journal of Technology (Thailand),* vol. 13, No. 4, pp. 193-202, 2010.

18) T. Cooklev, "Engineering standards and engineering education," *Journal of IT Standardization Research*, vol. 8, 2010, pp. 1-10.

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19) R. Cintra and T. Cooklev, “Robust image watermarking using non-regular wavelets,” *Journal of Signal, Image, and Video Processing*, 2008.

20) T. Cooklev, A. Pakdaman, J. Eidson, “IEEE 1588 over IEEE 802.11 for synchronization of wireless local area nodes,” *IEEE Trans. Instrumentation and Measurement*, vol. 56, No. 5, pp. 1632-1639, Oct. 2007.

21) T. Cooklev and A. Nishihara, “Analytic constructions of complementary sequences,” *IEICE Trans. Fundamentals*, November 2006.

22) T. Cooklev, “An efficient architecture for orthogonal wavelet transforms,” *IEEE Signal Processing Letters*, Feb. 2006.

23) T. Cooklev, “Standards for the wireless Internet,” *Annual review of communications*, vol. 57, Dec. 2004.

24) T. Cooklev, G. Berbecel and A. N. Venetsanopoulos, ``Wavelets and differential-dilation equations,'' *IEEE Trans. Signal Processing*, vol. 48, pp. 2258-2268, 2000.

25) T. Cooklev and A. Nishihara, “Biorthogonal coiflets,”*IEEE Trans. Signal Processing*, vol. 47, pp. 2582-2588, 1999.

26) T. Cooklev, A. Nishihara, T. Yoshida, and M. Sablatash, ``Multidimensional two-channel linear phase FIR filter banks and wavelet bases with vanishing moments," *Journal of Multimensional Systems and Signal Processing*, vol. 9, pp. 39-76, January 1998.

27) T. Cooklev, A. Nishihara and M. Sablatash ``Regular orthonormal and biorthogonal wavelet filters," *Signal Processing*, vol. 57, pp. 121-137, Feb. 1997.

28) T. Yoshida, T. Cooklev, A. Nishihara, and N. Fujii, "Design of non-separable 3-D QMF banks using McClellan transformations," *IEICE Trans. Fundamentals*, vol. E79-A, No. 5, May 1996, pp. 716-720.

29) M. Sablatash and T. Cooklev ``Coding of high-quality audio signals by wavelets and wavelet packets," *Digital Signal Processing: A Review Journal*, vol. 6, No. 2, pp. 96-107, April 1996.

30) V. Dimitrov, T. Cooklev, and B. Donevsky ``Number-theoretic transforms over the golden-section quadratic field," *IEEE Trans. Signal Processing*, No. 8, pp. 1790-1797, August 1995.

31) V. Dimitrov and T. Cooklev, ``Hybrid algorithm for computing the matrix polynomial," *IEEE Trans. Circuits Syst.*, No. 7, pp. 377-380, July 1995.

32) V. Dimitrov and T. Cooklev ``Two algorithms for modular exponentiation based on nonstandard arithmetics,'' Special issue on cryptography and information security, *IEICE Transactions on Fundamentals*, Jan. 1995.

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33) M. Sablatash , Todor Cooklev and Takuro Kida,``The coding of image sequences by wavelets, wavelet packets and adaptive wavelet packets," *IEEE Trans. Broadcasting*, Dec. 1994.

34) T. Cooklev and A. Nishihara, ``Partial and generalized FFT," *IEICE Trans. on Fundamentals*, Sept. 1994.

35) V. Dimitrov, T. Cooklev and B. Donevsky, "Generalized Fermat-Mersenne number theoretic transforms," *IEEE Trans. Circuits Syst.,* vol. 41, pp. 133-139, Feb. 1994.

36) T. Cooklev, T. Yoshida and A. Nishihara, ``Maximally flat half-band diamond-shaped FIR filters using the Bernstein polynomial," *IEEE Trans. Circuits Syst.,* vol. 40, pp. 749-751, Nov. 1993.

37) T. Cooklev and A. Nishihara, ``Maximally flat FIR Hilbert transformers," *Int. Journal Circuit Theory and Applications*, vol. 21, pp. 563-570, 1993.

38) T. Cooklev, S. Samadi, A. Nishihara and N. Fujii, Efficient implementation of all maximally flat FIR filters of a given order," *Electronics Lett.,* vol. 29, No. 7, pp. 598-599, 1993.

39) S. Samadi, T. Cooklev, A. Nishihara and N. Fujii, ``Multiplierless structure for maximally flat linear phase FIR filters," *Electronics Lett.,* vol. 29, No. 2, pp. 184-185, 1993.

40) V. Dimitrov, T. Cooklev and B. Donevsky, "Generalized Fermat number transforms," *ASME Journal on Numerical Modeling*, 1992, N. 4 pp. 11-22.

41) T. Cooklev, V. Dimitrov and B. Donevsky, "Systolic implementation of the complex Chebyshev structure," *Int. J. Electronics*, vol. 73, pp. 1247-1252, Dec. 1992.

42) T. Cooklev and A. Nishihara, "Efficient design of N--D hyperspherically symmetric FIR filters," *IEICE Transactions on Fundamentals of Electronics, Inform. and Comput. Sci.*, vol. E75-A, pp. 1739-1742. Dec. 1992.

43) T. Cooklev, V. Dimitrov and B. Donevsky, "An improved systolic implementation of complex digital filters," *Archiv fuer Elektronik und Uebertragungstechnik (Germany)*, vol. 46, pp. 434-436, Nov.-Dec. 1992.

44) V. Dimitrov, T. Cooklev and B. Donevsky, "On the multiplication of reduced biquaternions and applications," *Information Processing Letters,* vol. 43, pp. 161-164, Sept. 1992.

Conference Papers

45) Plamen Semov, Pavlina Koleva, Vladimir Poulkov, and Todor Cooklev, "Evolution of Mobile Networks and C-RAN on the Road Beyond 5G," 43rd Int. Conf. on Telecommunications and Signal Processing, Milan, Italy, July 2020.

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46) Y. Acar, S. Colak, T. Cooklev, "Dual-Mode Index Modulation Aided OFDM with Generalized Prefix", *Int. Symp. Networks, Computers, and Communications*, June 2019, Istanbul, Turkey.

47) T. Cooklev, "Making Software Defined Networks Semantic," *Proc. WINSYS*, July 2015, Colmar, France.

48) T. Cooklev, L. Stanchev, "A comprehensive and hierarchical ontology for wireless systems," *Wireless World Research Forum*, Marrakech, Morocco, May 2014.

49) Yusuf Acar, H. Yildiz, H. Dogan, and H. Dogan, "Generalized Prefix Approach for Alamouti Coded OFDM Systems over Gaussian Channels Correlated in Space," IEEE 2014 World Congress on Computer Applications and Information Systems (WCCAIS), Hammamet, Tunisia, January17-19, 2014.

50) Yusuf Acar, H. Yildiz, H. Dogan, and H. Dogan, "Performance Improvement for Correlated 4x4 MIMO-OFDM Systems by Generalized Prefix Approach," 2013 Int. Conference on Signal Processing and Communications, Dec. 12-14, Noida, Uttar Pradesh, India.

51) T. Cooklev, L. Stanchev, C. Chen, "Wireless cloud architecture based on thin clients and ontologies," *Proc. IEEE Midwest Symp. Circuits and Systems*, Columbus, OH, Aug. 2013

52) Acar, Y.; Yildiz, H.; Cooklev, T.; Dogan, H., "High-performance MIMO OFDM wireless systems with generalized prefix," *21st Signal Processing and Communications Applications Conference (SIU), 2013*, 24-26 April 2013, North Cyprus.

53) Dogan, H. Yildiz, T. Cooklev, Y. Acar, "Coded OFDM wireless systems with generalized prefix", Int. Conf. on Application of Information and Communication Technologies, Tbilisi, Georgia, Oct. 2012.

54) A. Madanayake, C. Wijenayake, Nghi Tran, T. Cooklev, Sean V Hum, L. T. Bruton, "Directional Spectrum Sensing using Tunable Multi-D Space-Time Discrete Filters," First IEEE International Workshop on Emerging COgnitive Radio Applications and aLgorithms (IEEE CORAL), San Francisco, CA June 2012.

55) Yazan A. Alqudah and T. Cooklev, Hands-On Open Access Broadband Wireless Technology Lab, *Proc. IEEE Global Engineering Education Conference (IEEE EDUCON),* Marrakech, Morocco, April 2012.

56) Yazan A. Alqudah and T. Cooklev, Hands-On Open Access Broadband Wireless Technology Lab, ASEE Illinois/Indiana Section Conference, Valparaiso, IN, March 2012.

57) D. Mueller, T. Cooklev, H. Oloomi, C. Pomalaza-Ráez, and S. Walter, "A Graduate Program In Wireless Technology And Systems Engineering: Overview And Initial Experiences", ASEE Illinois/Indiana Section Conference, Valparaiso, IN, March 2012.

58) L. Stanchev and T. Cooklev, "Describing Radio Hardware and Software Using OWL for Over-The-Air Software Download," SDR Forum Tech. Conference, Washington, DC, Dec. 2010.

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59) A. Marcum, T. Cooklev, and Carlos Pomalaza-Raez, “Simple OFDM,” Virginia Tech Wireless Summer School, June 2010.

60) C. Chen, Z. Chen, T. Cooklev, and C. Pomalaza-Raez, “On spectrum probing in cognitive radio networks: does randomization matter,” IEEE Int. Conf. Communications, May 2010.

61) Z. Chen, T. Cooklev, C. Chen, and Carlos Pomalaza-Raez, “Modeling primary user emulation attacks and defenses in cognitive radio networks,” Int. Performance Computing and Communications Conference, Dec. 2009, Phoenix, AZ

62) T. Cooklev and M. Cummings, “Changing metalanguage landscape,” SDR Forum Technical Conference, Washington, DC, Dec. 2009.

63) F. Ramirez-Mireles, T. Cooklev, and M. Sablatash, “Analysis of filter-based non-coherent detection of UWB FSK with antenna and multipath effects,” IEEE MILCOM 2008.

64) T. Cooklev and M. Cummings, “Networking description language for ubiquitous cognitive networking,” SDR Forum Technical Conference, Washington, DC, Nov. 2008.

65) M. Cummings, T. Cooklev, B. Lyles, P. A. Subrahmanyam, “Commercial wireless metalanguage scenario,” Software Defined Radio Technical Conference, Denver, CO, November 2007.

66) T. Cooklev and A. Abedi, “Teaching the IEEE wireless communication standards dynamically,” 2007 Frontiers in Education Conference, Milwaukee, WI, Oct. 10-13, 2007.

67) S. Gaur and T. Cooklev, “Using Finer AIFSN granularity to Accurately Tune the Flow Ratios in IEEE 802.11e,” The 18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Sept. 2007, Athens, Greece.

68) S. Gaur and T. Cooklev, “"Performance Enhancement of IEEE 802.11e EDCA by Random AIFSN", 2007 3rd International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities (TridentCom), Grosvenor Resort, Orlando, FL, May 21-23, 2007.

69) F. Ramirez-Mireles, and T. Cooklev, “Effects of Antenna and Multipath Frequency Selectivity on UWB Using Non-coherent FSK,” World Wireless Forum, Stanford, CA, May18-20 2007.

70) F. Ramirez-Mireles, and T. Cooklev, “An Investigation of Antenna and Multipath Effects on Pulse-Based UWB Using FSK,” IEEE Globecom, San Francisco 2006.

71) T. Cooklev and P. Siohan “Vector-transform-based OFDM”, Asilomar Conf. On Computers and Comm., Pacific Grove, Nov. 2006.

72) S. Gaur and Cooklev, T. “Performance enhancement of IEEE 802.11e EDCA by random AIFSN,” IEEE Wireless multimedia communication conf., Vancouver, BC, Canada, July 2006.

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73) T. Cooklev, Keh-Gang Lu “A wavelet transform approach to the design of complementary sequences for communications, 39th Asilomar Conference on Systems, Signals, and Computers, Pacific Grove, CA Nov. 2005.

74) M. Goins, T. Cooklev, and J. W. Hines, “System-on-a-chip design for lab-on-a-chip in space-flight systems,” Proc. Information Systems: New Generations, Las Vegas, NV, April 2005.

75) Y. Bai and T. Cooklev, “An improved method for lossless data compression” IEEE Data Compression Conference, Snowbird, Utah, March 2005.

76) A. Pakdaman, J. Eidson, T. Cooklev, “Synchronization of wireless LAN over IEEE 1588,” Int. Conference on IEEE 1588, Baltimore MD, Sept. 2004.

77) T. Cooklev, “Dynamic bandwidth allocation and channel coding for providing QoS in wireless networks,” Int. Conference on Telecommunications, Feb. 2003, Papeete, Tahiti.

78) T. Cooklev and M. Sablatash ``A wavelet transform approach to the design of sequences for communications," Wireless Communications'97, Calgary, July 1997.

79) M. Sablatash, John Lodge, and T. Cooklev ``Transmitter and receiver filter bank designs for bandwidth-on-demand multiple access communications combining wavelet packet filter bank trees and DFT polyphase filter banks" IEEE Int. Conference on Communications, Montreal, 1997.

80) G. Berbecel, T. Cooklev and A. N. Venetsanopoulos, ``A practical wavelet-based approaches to watermarking digital images," IEEE Conf. on Consumer Electronics, Chicago, IL, 1997.

81) T. Cooklev, G. Berbecel, A. N. Venetsanopoulos, ``Wavelets and differential-dilation equations" Canadian Workshop on Information Theory, Toronto, June 1997.

82) T. Cooklev, G. Berbecel, and A. N. Venetsanopoulos, ``Construction of an infinitely differentiable continuous-time wavelet and differential dilations equations," Int. Workshop on Signal and Image Processing, Manchester, UK, Nov. 1996.

83) T. Cooklev, A. Nishihara, M. Kato, and M. Sablatash ``Lattice structures for two-channel paraunitary filter banks that yield symmetric wavelet bases," EUSIPCO'96, Trieste, Italy, Sept. 1996

84) D. Androutsos, T. Cooklev, A. N. Venetsanopoulos, ``Multifilter banks and multiwavelets for multispectral image compression," World Congress of Nonlinear Analysts, Athens, July 1996.

85) T. Cooklev, ``On the design of orthogonal filter banks and wavelets with complex coefficients," Queen's Biennial Symposium on Communications, Kingston, June 1996.

86) T. Cooklev, ``Filter banks and wavelet transforms over finite fields," Queen's Biennial Symposium on Communications, Kingston, June 1996.

Ford Motor Co.
Exhibit 1004
Page 013

87) T. Cooklev, ``1-D and 2-D biorthogonal filter banks with vanishing moments and biorthogonal wavelet packets" Queen's Biennial Symposium on Communications, Kingston, June 1996.

88) T. Cooklev, ``Multichannel filter banks, vector transforms, and multiwavelets with applications in color image compression," Queen's Biennial Symposium on Communications, Kingston, June 1996.

89) T. Cooklev, A. Nishihara, M. Kato, and M. Sablatash ``Two-channel multifilter banks and multiwavelets," IEEE ICASSP'96, Atlanta, GA, pp. 2769-2773, May 1996.

90) T. Cooklev, et. al., ``Multifilters and multiwavelets," Wavelets in signal and image processing, Centre de recherche mathematique, Universite de Montreal, Montreal, Quebec, Canada, March 1996.

91) T. Cooklev, et al ``Regular biorthogonal filter banks and wavelet bases: new design and implementation," Int. Conf. Digital Signal Processing,, Limmasol, Cyprus, 1995.

92) T. Cooklev, A. Nishihara, T. Yoshida, and M. Sablatash ``Regular multidimensional linear phase FIR perfect-reconstruction filter banks and wavelet bases," IEEE ICASSP'95, Detroit, MI, May 1995.

93) T. Cooklev, A. Nishihara, and M. Sablatash ``Theory of digital filter banks over finite fields," IEEE Asia-Pacific Conf. Circuits Systems (APCCAS), Taipei, Taiwan, Dec. 1994.

94) T. Cooklev, T. Yoshida, A. Nishihara, ``Multidimensional linear phase FIR perfect-reconstruction filter banks," DSP Symposium, Nov. 1994, Kyoto, Japan.

95) M. Sablatash , Todor Cooklev and Takuro Kida, ``The coding of image sequences by wavelets, wavelet packets and adaptive wavelet packets," Int. Broadcasting Convention, Amsterdam, Holland, Sept. 1994.

96) Mike Sablatash , Todor Cooklev, ``Compression of high quality audio signals by wavelet packets and other methods," Kingston Biennial Symp. Communications, Kingston, Ontario, Canada, June 1994.

97) M. Sablatash , Todor Cooklev and Takuro Kida, ``The coding of image sequences by wavelets, wavelet packets, adaptive wavelet packets and other subband coding schemes," Kingston Biennial Symp. Communications, Kingston, Ontario, Canada, June 1994.

98) M. Sablatash , J. Lodge, and Todor Cooklev, ``Wavelets, matrices and filter banks," Canadian Applied Mathematics Symp., Montreal, Canada, June 1994.

99) Todor Cooklev, Toshiyuki Yoshida, Akinori Nishihara and Mike Sablatash, ``Multidimensional perfect reconstruction linear phase digital filter banks and wavelets,'' Canadian Applied Mathematics Symp., Montreal, Canada, June 1994.

Ford Motor Co.
Exhibit 1004
Page 014

100) V. Dimitrov and T. Cooklev, ``Hybrid algorithm for computing the matrix polynomial using a fractal number system,'' Proc. IEEE ISCAS, pp. 5.129-5.132, London, UK, 1994.

101) T. Cooklev and A. Nishihara, ``Multidimensional perfect-reconstruction linear-phase digital filter bank,'' Karuizawa Workshop on Circuits Systems, Karuizawa, Japan, April 1994.

102) T. Cooklev and A. Nishihara, ``Partial FFT,'' Proc. 8th Digital Signal Processing Workshop, Sendai, Japan, pp. 37-42, Oct. 1993.

103) T. Cooklev, S. Samadi, A. Nishihara and N. Fujii, ``Maximally flat approximation for two-dimensional FIR digital filters with applications in sampling structure conversion," ECCTD'95, Davos, Switzerland, pp. 385--390, Aug. 1993.

104) T. Cooklev and A. Nishihara, ``Maximally flat FIR filters," IEEE ISCAS, Chicago, IL, pp. 96-99, May, 1993.

105) T. Cooklev and A. Nishihara, ``Maximally flat FIR Hilbert transformers,'' Karuizawa Workshop on Circuits and Systems, Karuizawa, Japan, pp. 37-42, April 1993.

106) T. Cooklev and A. Nishihara, "Systolic structures for linear-phase FIR filters," 1st IEEE Asia Pacific Conference on Circuits and Systems, pp. 304-306, Sydney, Australia, Dec. 1992.

107) T. Cooklev and A. Nishihara, "A new class of 2--D FIR maximally-flat digital filters," 7th Digital Signal Processing Symposium, Fuji Res. Inst., Japan, pp. 115-120. Nov. 1992.

108) T. Cooklev and A. Nishihara, "Design of N-D hyper spherically symmetric FIR filters," IEICE Fall Conference, pp. A-82, Tokyo, Sept. 1992.

109) V. Dimitrov, T. Cooklev, B. Donevsky, "Fibonacci-based complex number theoretic transform," IASTED Int. Symposium Circuits Systems, Zurich, Switzerland, pp. 69-72, July 1991.

United States Patents

1) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 9,949,148, April 17, 2018.
2) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 9,936,401, April 3, 2018.
3) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 9,461,857, October 4, 2016.
4) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 9,450,794, September 20, 2016.
5) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 9,148,806, September 29, 2015.
6) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, Multicarrier packet communication system, U.S. Patent 9,148,801, September 29, 2015.

Ford Motor Co.
Exhibit 1004
Page 015

7) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 8,958,350, February 17, 2015.
8) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 8,842,570, September 23, 2014.
9) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 8,755,264, June 17, 2014.
10) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, "Systems and methods for high rate OFDM communications" U.S. Patent 8,553,579, Oct. 8, 2013.
11) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, Multicarrier packet communication system, U.S. Patent 8,537,703, September 17, 2013.
12) M. Tzannes, D. Lee, T. Cooklev, and C. Lanzl, Systems and methods for high rate OFDM communications using first and second cyclic prefix lengths and first and second pilot tones, U.S. Patent 8,416,677, April 9, 2013.
13) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, OFDM communications using bit allocation tables, U.S. Patent 8,284,800, October 9, 2012.
14) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Systems and methods for high rate OFDM communications using first and second cyclic prefix lengths, U.S. Patent 8,159,969, April 17, 2012.
15) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, High rate OFDM communications using bit allocation tables, 7,924,841, May 17, 2011
16) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Method for packet communication using training packets, U. S. Patent 7,944,851, May 17, 2011
17) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Method for variable cyclic length in OFDM communications, 7,916,625, March 29, 2011
18) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, High rate OFDM communications with a variable cyclic prefix, 7,804,765, September 28, 2010
19) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Multicarrier packet communication method, 7,729,281, June 1, 2010
20) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Systems and methods for high rate OFDM communications, 7,590,071, September 15, 2009
21) M. Tzannes, D. Lee, T. Cooklev, C. Lanzl, Systems and methods for high rate OFDM communications, 7,522,514, April 21, 2009
22) Kenneth Morley; Todor Cooklev, Mark Gray; Darrin Gibbs; Video signal processing method and apparatus for internet appliances or embedded systems, US Patent 6,795,869, September 2004.
23) Todor Cooklev, Darrin Gibbs; Mark Gray; Ken Morley; Method and system for performing speech recognition for an internet appliance using a remotely located speech recognition application, US Patent 6,772,123, August 2004.
24) T. Cooklev, Device and method for compensating or creating doppler effect using digital signal processing, US Patent, 6,633,617, Oct. 2003.
25) S. Messerly, T. Cooklev, "Adaptive filter size for the efficient computation of wavelet packet trees," US Patent 6,581,081, June 2003.
26) T. Cooklev, "Method and system for spatially-disjoint joint source and channel coding for high-quality real-time multimedia streaming over connection-less networks via circuit-switched interface links," US Patent 6,574,218, June 2003.
27) T. Cooklev, M. Gray, "System and method for precise DTMF detection," US Patent 6,560,331, May 2003.

Ford Motor Co.
Exhibit 1004
Page 016

28) T. Cooklev, K. Smart, "High-speed modem operating over two or more telephone lines," US Patent 6,490,295, Dec. 2002.
29) T. Cooklev, M. Gray, D. Gibbs, K. Morley, "Method and apparatus for continuously variable slope delta modulation coding of signals," US Patent 6,486,810, Dec. 2002.
30) S. Messerly, T. Cooklev, "Reduced computation system for wavelet transforms," US Patent 6,466,957, Oct. 2002.
31) T. Cooklev, "Method and apparatus for wavelet-based digital watermarking of signals", US Patent, March 2002.
32) T. Cooklev, ``Method for real-time lossless data compression of computer data, US Patent 6,289,130, Sept. 11, 2001.

Selected non-refereed publications

Contributions to 3GPP

1) "CQI Definition for CoMP," 3GPP TSG-RAN WG1 Meeting #68 R1- 120243, Dresden, Germany, February 6th – 10th 2012. (on behalf of Hitachi)
2) "Specification Impact of Non-Zero Power ABS", 3GPP TSG-RAN WG1 Meeting #68R1-120241, Dresden, Germany, February 6th – 10th 2012. (on behalf of Hitachi)
3) "Way Forward on CSI Feedback for CoMP," R1-120901, (authored by a group of companies)
4) "WF on CSI-RS based measurement," R1-120895 (authored by a group of companies)
5) LS to RAN3 – "X2 enhancements in support of non-zero power ABS," 3GPP TSG RAN WG1 Meeting #69, Prague, Czech Republic, May 2012 (on behalf of Hitachi)
6) "WF on signalling details for non-zero transmit power ABS," R1-123948, (co-authored with representatives from several companies), Prague, Czech Republic, May 2012 (on behalf of Hitachi)
7) "WF on X2 signalling for reduced power ABS for FeICIC," (co-authored with representatives from several companies) R1-123881, Prague, Czech Republic, May 2012

Contributions to IEEE 802.11

8) G. Venkatesan, A. Ashley, Ed Reuss, and T. Cooklev, "IEEE 802 Tutorial: Video over 802.11," March 2007. (on behalf of Hitachi America Ltd)
9) T. Cooklev, "Video over WLAN", doc. 11-07-0105r0, 2007. (on behalf of Hitachi America Ltd)
10) S. Gaur, T. Cooklev, "MAC improvement using random AIFSN," doc. 802.11-06/0657, July 2006. (on behalf of Hitachi America Ltd)
11) C. Tavares, T. Cooklev, S. Gaur, "On video over 802.11," doc. 802.11-06/0039, Jan. 2006. (on behalf of Hitachi America Ltd)
12) C. Tavares, T. Cooklev, "MAC extensions for HDTV," doc. 802.11-05/0632, July 2005. (on behalf of Hitachi America Ltd)
13) M. Tzannes, T. Cooklev, D. Lee, C. Lanzl, "Extended data rate 802.11a", doc. 802.11-02/232, March 2002. (on behalf of Aware, Inc.)
14) S. Prestwich, D. Ostermiller, K. Dobson, T. Cooklev, "Dynamic frequency hopping," IEEE 802.15, Tel Aviv, Israel, January 2000. (on behalf of Aware, Inc.)

Ford Motor Co.
Exhibit 1004
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Contributions to ITU-T SG15 Q4 on DSL technology

15) T. Cooklev, A. Freedman, and M. Tzannes, "Low-density parity check codes (LDPC) for ADSL," ITU-T SG15 Q4 BI-068, Bangalore, India, Nov. 2000. (on behalf of Aware, Inc.)
16) T. Cooklev, M. Tzannes, A. Freedman, "Low-density parity check coded modulation for ADSL," ITU-T SG15 Q4 BI-081, Bangalore, India, 2000. (on behalf of Aware, Inc.)
17) T. Cooklev, "Error-correcting codes for ADSL," ITU-T SG15 Q4, BA-108, Antwerp, Belgium, June 2000. (on behalf of Aware, Inc.)

Other non-referred publications and technical reports

18) T. Cooklev, "Standards, regulation, and compliance," IEEE Standards University, [online] https://www.standardsuniversity.org/e-magazine/september-2017/standards-regulation-compliance/
19) T. Cooklev A wavelet transform approach to the design of sequences for communications, Communications Research Centre, Ottawa, Tech. Report U6800-6-2438, 1997.
20) I. Rabinovitch, A. N. Venetsanopoulos, and T. Cooklev, ``Perceptually lossless still image compression using the wavelet transform, considering the properties of the Human Visual System," ITRC, Kingston, Ontario, 1996.
21) T. Cooklev, On the design and implementation of filter banks and filter bank trees with finite wordlength, Communications Research Centre, Ottawa, Tech. Report 67CRC-5-3315, 1996.
22) T. Cooklev, M. Kato, A. Nishihara, M. Sablatash ``Multifilter banks and multiwavelets," IEICE Tech. Report, Tokyo, Japan, May 1995.
23) T. Cooklev, A. Nishihara, ``Regular biorthogonal filter banks and wavelet bases: new design and implementation," IEICE Tech. Report, presented at KDD Research Institute, Kamifukuoka, Saitama, Japan, April 1995.
24) V. Dimitrov and T. Cooklev, ``Two algorithms for modular exponentiation using non-standard arithmetics,'' IEICE Tech. Report, ISEC93-98, 1994. (in Japanese), presented at the IEICE meeting on information security and cryptography, Osaka, Japan, March 1994.
25) T. Cooklev and A. Nishihara, ``Pruning the real-valued FFT algorithms for efficient time-domain interpolation and linear convolution,'' IEICE Tech. Report, CAS93-14, VLD93-14, DSP93-24, May 1993.
26) T. Cooklev and A. Nishihara, ``Band pass maximally flat FIR filters and Hilbert transformers," IEICE Tech. Report, CS92-88, DSP92-88, Jan. 1993.

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All cases in which a report or testimony by deposition or trial has been provided

2021 – Expert for TQ Delta, Austin, TX

- Law firm: Davis Law Firm, P.C., Longview TX, and McAndrews, Chicago, IL
- Case name: TQ Delta, LLC, v. Commscope Holding Company, Inc., Commscope Inc., Arris International Limited, Arris Global Ltd, Arris US Holdings, Inc., Arris Solutions, Inc., Arris Technology, Inc., and Arris Enterprises, LLC
- Civil Action No: 2:21-cv-310-JRG, 2:21-cv-309-JRG (*E.D. Tex*.)
- Submitted a declaration in connection with claim construction, infringement report, validity report, and reports on testing and simulation
- Testified at two depositions

2021 – 2022 Expert for WSOU Investments, LLC d/b/a Brazos Licensing and Development

- Law firm: Kasowitz Benson Torres LLP
- Case name: *WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Canon, Inc*.,
- Case Nos. *6:20-cv-00980-ADA, 6:20-cv-00981-ADA (W.D. Tex.)*
- Submitted a declaration in connection with claim construction, infringement and validity reports.
- Testified at a deposition
- Technologies at issue: frequency-hopping wireless communication; image processing and compression

2021 – 2022 Expert for NXP

- Law firm: Jones Day, Washington, DC
- Case name: Certain Integrated Circuits, Chipsets, and Electronic Devices, and Products Containing the Same, ITC 337-TA-1287
- Technology at issue: IEEE 802.11
- Submitted a validity report
- Testified at a deposition

2019 – 2022 Expert for Evolved Wireless LLC, Austin, TX

- Law firm: Nelson Bumgardner Albritton P.C., Fort Worth, TX (2019–22); Bruster PLLC, Southlake, TX (2022–present)
- PTAB Case No. IPR2021-00943
- Submitted a declaration
- Testified at a deposition
- Technology at issue: 4G cellular communications

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2021 – Expert for Flexiworld Technologies

- Law firm: Nelson Bumgardner Conroy, Dallas, TX
- Case name: *Roku, Inc.* v. *Flexiworld Technologies*
- PTAB Case Nos. IPR2021-00713, IPR2021-00714, IPR2021-00715, PGR2021-00112, IPR2022-00775
- Submitted declarations
- Testified at multiple depositions

2021 – 2022 Expert for 3G Licensing

- Law firm: Devlin Law Firm LLC
- Case name: *Cradlepoint, Inc., Dell Inc., Honeywell International, Inc., Sierra Wireless, Inc., TCL Communication Technology Holdings Limited, TCT Mobile International Limited, TCT Mobile, Inc., TCT Mobile (US) Inc., TCT Mobile (US) Holdings Inc., Thales DIS AIS Deutschland Gmbh, ZTE Corporation, and ZTE (USA) Inc.* v. *3G Licensing, S.A.*
- PTAB Case Nos. IPR2021-00640, IPR2021-01141
- Technology at issue: cellular communications
- Submitted declarations
- Testified at a deposition

2021 – 2021 Expert for Barkan Wireless IP Holdings, L.P.

- Law firm: Heim, Payne & Chorush, LLP, Houston, TX
- Case name: *Barkan Wireless* v. *T-Mobile, Inc. and Nokia of America Corp.*
- Civil Action No. *2:21-CV-00034-JRG (E. D. Tex.)*
- Submitted a validity report
- Testified at a deposition
- Technology at issue: cellular network architecture involving home base stations

2020 – 2021 Expert for General Access Solutions, Dallas, TX

- Law firm: Bartlit Beck, Denver, CO
- Case name*: General Access Solutions, LTD. v. Virgin Mobile USA, L.P., Boost Mobile, LLC, and Sprint Spectrum L.P.*
- Civil Action *No. 2:20-cv-00007-RWS (E. D. Tex.)*
- Submitted a report on standards essentiality
- Testified at a deposition
- Technology at issue: beamforming in 4G and 5G cellular standards

2014 – Expert for TQ Delta, Austin, TX

- Law firm: McAndrews, Chicago, IL
- Case name: TQ Delta, LLC v. Adtran
  Civil Action *No. 14-cv-00954-RGA (D-Del.)*, Civil Action *No. 15-cv-00121-RGA* (*D-Del.*)
- Case name: TQ Delta, LLC v. 2Wire
  Civil Action *No. 13-cv-1835-RGA (D-Del.)*

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- Case name: TQ Delta, LLC v. Zhone Technologies, Inc.
  Civil Action *No. 13-cv-1836-RGA (D-Del.)*
- Case name: TQ Delta, LLC v. Zyxel Communications, Inc. and Zyxel Communications Corporation
  Civil Action *No. 13-cv-2013-RGA (D-Del.)*
- Submitted product testing reports, computer simulation reports, a report on the terms of a license agreement, a report on standards essentiality, infringement reports, validity reports
- Testified at depositions and trials
- Technology at issue: Digital signal processing in Digital Subscriber Line communication systems

2015 – 2019 Expert for Evolved Wireless, Austin, TX

- Law firm: Robins Kaplan, Minneapolis, MN
- Civil Actions *No. 15-cv-542-SLR-SRF, No. 15-cv-543-SLR-SRF, No. 15-cv-544-SLR-SRF, No. 15-cv-545-SLR-SRF, No. 15-cv-546-SLR-SRF*, and *No. 15-cv-547-SLR-SRF (D-Del.)* brought against Apple, HTC, Lenovo, Samsung, ZTE, and Microsoft.
- Submitted infringement and validity reports
- Testified at deposition and trial
- Technologies at issue:
  - Random-access procedure in the LTE cellular standard
  - Generation and format of the random-access preamble in LTE
  - Handover and contention-free random access in LTE
  - Constant-amplitude zero-autocorrelation sequences in LTE

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