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## **SUMMARY**

Dr. Lo is an independent consultant specializing in wireless communications, with over 30 years of experience in telecommunications, satellite communications, and wireless technologies. His expertise spans antennas, RF, modulation/coding, radio protocols, and wireless standards, including 3G, 4G, 5G, and 802.11. Throughout his career, he has worked across various sectors such as intellectual property development, R&D, product development, network deployment, and design services, providing him with a comprehensive understanding of the telecommunications and wireless industry ecosystem.

Dr. Lo is a pioneer in smart antenna technology for wireless and satellite communications. He co-authored "Digital Beamforming in Wireless Communications," the first technical reference book on smart antennas, published by Artech House in 1996. He holds over 180 US and foreign patents in wireless communications and has published more than 80 technical papers in international journals and conferences. He frequently presented and lectured at industry and professional venues on topics related to antennas, RF, and wireless communications, providing numerous lectures to technical and industrial communities.

Before his current role, Dr. Lo worked in several startups, focusing on the research and development of OFDM/OFDMA technologies and products, including 3GPP LTE/LTE-A and IEEE 802.11. Prior to his startup ventures, he was at AT&T Wireless, where he led a cross-division team in developing key technologies for the world's first carrier-grade and commercially deployed OFDMA wireless system. He also served as a project/program manager at the Communications Research Laboratory, McMaster University, leading a team of 20 research engineers, scientists, and graduate students in R&D of wireless and satellite communications technologies.

Dr. Lo earned his B.A.Sc. from the University of British Columbia, Vancouver, Canada, and his M.Eng. and Ph.D. degrees from McMaster University, Hamilton, Ontario, Canada, all in electrical engineering. He was an affiliated professor at the University of Washington, Seattle, WA, from 2008 to 2012. He has held various leadership positions within the Institute of Electrical and Electronics Engineers (IEEE) and is a senior IEEE member and a member of the IEEE Eta Kappa Nu Honor Society.

## **EDUCATION**

Ph.D., Department of Electrical and Computer Engineering, McMaster University, Hamilton, Ontario, Canada

M.Eng., Department of Electrical and Computer Engineering, McMaster University, Hamilton, Ontario, Canada

B.A.Sc., Department of Electrical Engineering, the University of British Columbia, Vancouver, British Columbia, Canada

## EMPLOYMENT HISTORY

- Jan. 2014 – present*      **Freelance Wireless Technology Consultant**, Bellevue, Washington
- Responsibility:      Providing consulting services to clients in various industries in the following aspects:
- Analysis, evaluation, and legal procedure support of wireless-technology IP portfolios
  - Analysis and evaluation of technology markets and industry ecosystems
- Jan. 2005 – Dec. 2013*      **VP of Technology and Operations**, Neocific, Inc., Bellevue, Washington
- Responsibility:      Managing development and maintenance of intellectual property portfolio  
Providing consulting services to clients with analysis and evaluation of wireless-technology IP portfolios  
Managing and mentoring a team of engineers in the design and development of advanced wireless technologies:
- Technology research and development
  - Engineering management
- Directing company's daily operations and business development
- Dec. 2003 – Dec. 2005*      **VP of Engineering and Operations**, Waltical Solutions, Inc., Bellevue, Washington
- Responsibility:      Managing engineering teams at different sites in the design and development of broadband wireless and wire communication systems:
- Product development
  - Technology development
  - Engineering management
- Directing company's daily operations and business development
- Mar. 2001 – Aug. 2003*      **Principal Member of Technical Staff**, Nextcomm, Inc., Bellevue, Washington
- Responsibility:      Leading in R&D of WLAN technologies and products and providing support and supervision to a team of engineers:
- The development of baseband signal processor for *IEEE 802.11a/g* wireless local area networks (WLAN): from conceptual design to fixed-point model to FPGA prototype realization.
  - The system architecture of the *IEEE 802.11a/g* baseband signal processor: from radio front end to interface with MAC
- Leading in intellectual property development:
- Internal R&D projects to develop enabling technologies
  - Participation and contribution in *IEEE802.11*
- Apr. 1997 – Mar. 2001*      **Principal Member of Technical Staff**, AT&T Wireless, Redmond, Washington
- Responsibility:      Leading a cross-division team of researchers and engineers from AT&T Labs-Research and AT&T Wireless technology development and business units in R&D of key technologies for the world's first carrier-grade and commercially deployed OFDMA wireless system
- July 1988 –*      **Project/Program Manager and Senior Research Engineer**, the

- June 1997* Communications Research Laboratory, McMaster University, Hamilton, Ontario, Canada
- Responsibility: Managing industrial and governmental R&D contracts as well as academic research programs; leading a cross-discipline team of engineers, scientists and scholars to carry out independent studies, analysis, interpretations, conclusions and recommendations on various engineering projects
- Jan. 1990 – March 1997* **Principal Consultant**, TL Associates, Hamilton, Ontario, Canada
- Responsibility: Providing consulting services to both industrial companies and governmental agencies, including Canadian Space Agency and Department of National Defense, in the areas of smart antenna technology and signal processing techniques

### **MEMBERSHIP AND PROFESSIONAL ACTIVITIES (selected list)**

#### *Current:*

- Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)
- Member of IEEE Eta Kappa Nu Honor Society
- Vice Chair of IEEE Seattle Communications Joint Chapter from 2019
- Committee member of IEEE Connect the Unconnected (CTU) Competition

#### *Past:*

- Finance chair and Treasurer of the IEEE Global Humanitarian Technology Conference from 2019 to 2022.
- Co-Chair of Entrepreneurship and Innovation Forum in the IEEE Future Network World Forum from 2018 to 2022
- Startup subcommittee chair of the Industry Outreach Board of the IEEE Communications Society since 2017
- Technical program coordinator for the IEEE Seattle 5G Workshop 2019
- Chair of IEEE Seattle Joint Chapter of Communications Society, Vehicular Technology Society, Broadcast Technology Society, Information Theory Society, and Intelligent Transportation Systems Society from 2011 to 2018
- Treasurer of IEEE Seattle Section in 2017 and 2018
- Audit Committee of IEEE Seattle Section from 2014 to 2018
- General co-Chair of IEEE 5G Summit Seattle 2016
- Award Committee of IEEE Seattle Section in 2015
- Organization committee 2013 IEEE Seattle Metro Area Workshop "Vision of the Future"
- Technical publication referee for IEEE transactions and Journals
- Technical publication referee for IEE proceedings
- Participant and contributor in the IEEE 802.11 and IEEE802.16 Standard Work Groups
- Short Course Committee Chair, IEEE Northcon'98
- Research grant referee for Natural Science and Engineering Research Council (NSERC) of Canada

### **PUBLICATIONS (selected list)**

#### **A. BOOKS**

1. Henry Leung and Titus Lo, "Array signal processing using radial-basis function neural network," in S. Haykin, Editor, *Advances in Spectrum Analysis and Array Processing: Volume III*, Prentice-Hall, 1995.

2. John Litva and Titus Lo, *Digital Beamforming in Wireless Communications*, Artech House, 1996.
3. John Litva, Anupreet Sandhu, Keizo Cho, and Titus Lo, "Adaptive Beamforming in Wireless Communications" in T. Rappaport, B. Woerner, J. Reed, W. Tranter, Editors, *Wireless Personal Communications: The Evolution of Personal Communications Systems*, Springer, 1996.

## **B. PATENTS**

1. Vahid Tarokh and Titus Lo, "Near-optimal low complexity decoding of space-time codes for fixed wireless applications," US6,188,736, US6,470,043, US6,741,635, US7,046,737, US7,526,040, US8,179,991
2. Titus Lo, Dennis Rosenauer, and Doug Stolarz, "Method for combining communication beams in a wireless communication system," US6,377,783, US6,987,958
3. Titus Lo and Vafa Ghazi, "Method for error compensation in an OFDM system with diversity," US6,442,222, US6,901,125, US7,428,285, US8,223,903, US8,532,239
4. Titus Lo, "Maximum ratio transmission," US6,459,740, US6,826,236, US7,274,752, US7,362,823, US7,609,771, US8,520,746
5. Titus Lo, Adnan Abu-Dayya, and Mike Hirano, "Multicarrier transmission using polarized antennae," PCT/US2001/018993
6. Titus Lo and Ruifeng Wang, "Turbo channel estimation for OFDM systems", US6,940,914, US7,440,507, US7,656,958, US8,503,548, US8,681,887, US9,148,326
7. Titus Lo, "Adaptive communications system and method," US7,181,246
8. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, "Methods and apparatus for multi-carrier communication systems with adaptive transmission and feedback," US7,693,032, US8,027,367, US9,301,296, US10,075,941, US10,834,706, US11,032,801, US11,496,259, US11,522,650, US11,683,136, US12,003,439, CN200580004761.3, KR10-0804651
9. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, "Methods and Apparatus for Multi-Carrier Communications with Variable Channel Bandwidth," US7,787,431, US8,953,641, US10,511,417, US11,082,172
10. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, "Methods and apparatus for overlaying multi-carrier and direct-sequence spread spectrum signals in a broadband wireless communication system," US7,864,725, EP1712019B1, EP2723003, EP3208985B1, CN200580003185.0, CN201010576020.5, KR10-0818774
11. Xiaodong Li, Haiming Huang, Titus Lo, Ruifeng Wang, "Method and apparatus for multi-carrier packet communication with reduced overhead," US7,948,944, US8,634,376, US8,693,430, US9,042,337, US9,735,944, US10,447,450, US10,958,398, US11,329,785, US11,424,891, US11,424,892, US11,528,114, US11,722,279, US11,924,137, US11,924,138, CN200680009811.1, CN201210111079.6
12. Xiaodong Li and Titus Lo, "Frequency correction in multi-carrier communication systems," US7,957,341, US8,526,411, US9,326,262, US10,045,319, US10,681,662, US11363554
13. Xiaodong Li, Kemin Li, Titus Lo, Haiming Huang, "Methods and apparatus for random access in multi-carrier communication systems," US7,995,967, US8,467,366, US9,565,700, US10,390,369, US11,502,888, CN200580007552.4, KR10-804667
14. Xiaodong Li, Titus Lo, Kemin Li, and Haiming Huang, "Methods and apparatus for multi-carrier, multi-cell wireless communication networks," EP1712089B1, CN200580001222.4, CN201010154096.9, KR10-808462
15. Xiaodong Li, Titus Lo, Kemin Li, and Haiming Huang, "Methods and apparatus using cell-specific and common pilot subcarriers in multi-carrier, multi-cell wireless communication

- networks,” US8,009,660, US8,934,473, US9,065,614, US9,749,168, US11,324,049, US11,388,034
16. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, “Methods and apparatus for communication systems with time-division duplexing,” US8,014,264, CN200580013366.1
  17. Xiaodong Li, Kemin Li, Titus Lo, Haiming Huang, Jun Meng, “Methods and apparatus for power control in multi-carrier wireless systems,” US8,031,686
  18. Titus Lo and Xiaodong Li, “Methods and apparatus for multiple-antenna systems in cellular communication and broadcasting,” US8,041,395, US8,116,822, US8,326,366, US9,048,540, CN200680016367.6
  19. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, “Methods and apparatus for cellular broadcasting and communication system,” US8,089,911, US8,374,115, US8,634,375, US10,044,517, US10,862,696, US10,931,491, US10,862,696, US10,931,469, CN200680000320.0, CN201210195003.6
  20. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, “Methods and apparatus for signal transmission and reception in a broadband communication system,” US8,094,611, US8,428,009, US8,767,522
  21. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, “Methods and apparatus for a power efficient broadcasting and communication system,” US8,155,098, US8,457,081, US8,934,394, US9,780,959, US20200259676, CN200680000425.6, CN201010557763.8
  22. Xiaodong Li, Titus Lo, Kemin Li, and Haiming Huang, “Method, apparatus, and system for mitigating pilot signal degradation by employing cell-specific pilot subcarrier and common pilot subcarrier techniques in a multi-carrier cellular network,” US8,432,891
  23. Titus Lo and Xiaodong Li, “Methods and apparatus for flexible use of frequency bands,” US8,547,884, US9,363,066, US9,839,037, US11,310,795, US11,510,201, US11,483,832, US11,510,201, US11,510,202, US11,985,646
  24. Titus Lo and Xiaodong Li, “Multiple receivers in an OFDM/OFDMA communication system,” US8,548,086, US9,025,650, US9,882,759
  25. Titus Lo and Xiaodong Li, “Methods and apparatus for multi-carrier communications with efficient control signaling,” US8,565,181, US9,843,468
  26. Xiaodong Li, Haiming Huang, Titus Lo, Kemin Li, “Methods for multi-carrier communication systems with Automatic Repeat Request (ARQ),” KR10-818243
  27. Xiaodong Li, Haiming Huang, Titus Lo, Kemin Li, “Methods and apparatus for multi-carrier communication systems with ARQ,” US8,571,057, US9,083,500, US9,509,451, US10,313,061, US10,659,197 CN201210020099.2, KR10-818771
  28. Xiaodong Li, Kemin Li, Titus Lo, Haiming Huang, Jun Meng, “Method and apparatus for interference control in a multi-cell communication system,” US8,675,563, US9,755,809
  29. Xiaodong Li and Titus Lo, “Transmission of synchronization and control signals in a broadband wireless system,” US8,705,399, US9,014,128, US9,781,730
  30. Xiaodong Li, Titus Lo, Kemin Li, Haiming Huang, “Methods and apparatus for subframe configuration and generation in a multi-carrier communication system,” US8,724,443, US9,198,179, US9,750,012, US10,368,347, US10,841,919, US10,959,221, US11,503,588
  31. Xiaodong Li and Titus Lo, “Methods and systems for correlated information services,” PCT/US2007/084174
  32. Xiaodong Li and Titus Lo, “Multi-carrier modulation with hierarchical resource allocation,” US9,036,573, US9,730,205
  33. Titus Lo and Xiaodong Li, “Methods and apparatus for contingency communications,” US9,275,540, US9,773,406, US10,325,483, US11,049,384, US11,501,632, US11,941,971, EP2813063B1
  34. Titus Lo and Xiaodong Li, “Multiple-antenna system for cell-specific and user-specific transmission,” US9,344,313, US10,149,173, US10,567,976, US11,197,172, US11,825,314

35. Xiaodong Li and Titus Lo, "Methods and apparatus for signal conditioning in OFDMA systems," US9,363,123
36. Xiaodong Li, Titus Lo, Kemin Li, and Haiming Huang, "Channel probing signal for a broadband communication system" US9,948,488, US10,771,302, US10,826,740, US10,833,908, US11,368,347, US11,804,870
37. Xiaodong Li, Titus Lo, Kemin Li, and Haiming Huang, "Differential randomization of cell-specific and common pilot subcarriers in multi-carrier, multi-cell wireless communication networks" US10,326,631, US10,965,512
38. Xiaodong Li, Haiming Huang, Titus Lo, Kemin Li, "Methods and apparatus for multi-carrier communication systems with automatic repeat request (ARQ)," US11,265,113
39. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, "Method and apparatus for periodic and polled channel quality feedback," US11,115,229
40. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, "Broadcast signal indicating one or more subframe configurations," US11,296,900, US11,658,838
41. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, "Method and apparatus for receiving broadcast information in an ofdm communication system" US11,979,248
42. Haiming Huang, Xiaodong Li, Titus Lo, Kemin Li, "Bitmap based resource scheduling in a wireless network," US11,283,640

### **C. REFEREED JOURNAL PAPERS**

1. Titus Lo and John Litva, "Adaptive beam-space nulling of multipath signals," *IEEE Transactions on Antenna and Propagation*, vol. 37, no. 1, Jan.1990.
2. Titus Lo, Henry Leung, and John Litva, "Non-linear beamforming," *Electronics Letters*, vol. 27, no. 4, Feb. 1991.
3. Titus Lo, Tim Wong, and John Litva, "A new technique for low-angle radar tracking," *Electronics Letters*, vol. 27, no. 6, March 1991.
4. Titus Lo and John Litva, "Use of a highly deterministic multipath signal model in low-angle tracking," *IEE Proceedings Part F*, vol. 138, no. 2, Apr. 1991.
5. Titus Lo and John Litva, "Low-angle tracking using a multi-frequency sampled aperture radar: An experimental investigation," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 27, no. 5, Sept. 1991.
6. Titus Lo and John Litva, "Angles of arrival of indoor multipath," *Electronics Letters*, vol. 28, no. 18, Aug. 1992.
7. Ji Chen, Titus Lo, and John Litva, "Scattering of electromagnetic waves from a time-varying fractal surface," *Microwave and Optical Technology Letters*, vol. 6, no. 1, Jan 1993.
8. Henry Leung, Titus Lo, and John Litva, "Angle-of-arrival estimation in multipath environment using chaos theory," *Signal Processing*, **31** (1993) pp. 57-68.
9. Titus Lo, John Litva, and Henry Leung, "Estimating the impulse response of indoor radio channels using signal subspace techniques," *IEE Proceedings Part I*, vol. 140, no. 3, June 1993.
10. Henry Leung and Titus Lo, "Chaotic signal processing over the sea," *IEEE Journal Oceanic Eng.*, vol. 18, no.3, July 1993.
11. Titus Lo, Henry Leung, John Litva, and Simon Haykin, "Fractal characterization of sea scattered signals," *IEE Proceedings Part F*, vol.140, no. 4, Aug. 1993. (The authors of this paper won the 1993/1994 Mountbatten Premium awarded by the Institute of Electrical Engineers, London, England.)
12. Tim Wong, Titus Lo, Henry Leung, John Litva, and Eloi Bosse, "Low angle target tracking using radial basis function neural networks," *IEE Proceedings Part F*, vol.140, no. 5, Aug. 1993.

13. Henry Leung, Titus Lo, and John Litva, "Nonlinear Adaptive Signal Processing Based on Rational Function," *Signal Processing*, **38** (1994), pp. 153-168.
14. Titus Lo, Henry Leung, and John Litva, "Radial basis function neural network for direction-of-arrivals estimation," *IEEE Signal Processing Letters*, vol. 1, no. 2, Feb. 1994.
15. Fengzhen Wang, Titus Lo, John Litva, and William Read, "VHF antenna array processing: High accuracy direction finding and performance evaluation with real data," *IEE Proceedings - Radar, Sonar, Navig.*, vol. 141, no. 3, June 1994.
16. Titus Lo, Henry Leung, and John Litva, "Low-angle radar tracking in a naval environment using forward-backward nonlinear prediction method," *IEEE Journal Oceanic Eng.* vol. 19 no. 3, July 1994.
17. Ji Chen, Chen Wu, Titus Lo, Keli Wu, and John Litva, "Using linear and nonlinear predictors to improve the computational efficiency of FD-TD algorithm," *IEEE Transactions on Microwave Theory and Tech.*, vol. 42, no. 10, Oct. 1994.
18. Titus Lo, John Litva, and Henry Leung, "A new approach for estimating indoor radio propagation characteristics," *IEEE Transactions on Antenna and Propagation*, vol. 42, no. 10, Oct. 1994.
19. Titus Lo, Henry Leung, and John Litva, "Artificial neural network for AOA estimation in a multipath environment over the sea," *IEEE Journal Oceanic Eng.*, vol. 19 no. 4, Oct. 1994.
20. Henry Leung and Titus Lo, "A spatial temporal dynamical model for sea scattered signals," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 33, no.2, March 1995.
21. Fengzhen Wang, Titus Lo, John Litva, and William Read, "Performance of DF techniques with a real VHF array," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 31, no. 2, April 1995.
22. Ji Chen, Henry Leung, Titus Lo, John Litva, and Martin Blachette, "A modified probabilistic data association filter in real clutter," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 32, no. 1, Jan. 1996.
23. Fengzhen Wang, John Litva, Titus Lo, Eloi Bosse, and Henry Leung, "Feature-mapping data fusion," *IEE Proceedings - Radar, Sonar and Navigation*, vol. 143, no.1 Feb. 1996.
24. Fengzhen Wang, John Litva, Titus Lo, and Eloi Bosse, "Performance of neural data association," *IEE Proceedings - Radar, Sonar and Navigation*, vol. 143, no.1 Feb. 1996.
25. Ji Chen, Titus Lo, Henry Leung, and John Litva, "The use of fractal for modeling EM waves scattering from rough sea surface," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 34, no. 4, July 1996.
26. Ying Zhang, Henry Leung, Titus Lo, and John Litva, "A distributed sequential nearest neighbor multitarget tracking algorithm," *IEE Proceedings - Radar, Sonar and Navigation*, vol. 143, no. 4, Aug. 1996.
27. Shiping He, Titus Lo, and John Litva, "A spread spectrum system with a time domain processing device," *IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing*, Special Issue on Low Power Wireless Communications, vol. 44, no. 6, June 1997.
28. Ying Zhang, Henry Leung, Martin Blachette, Titus Lo, and John Litva, "An efficient decentralized multiradar multitarget tracker for air surveillance," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 33, no. 4, Oct. 1997.
29. Vahid Tarokh and Titus Lo, "Principal ratio combining for fixed wireless applications when transmitter diversity is employed," *IEEE Comm. Letters*, vol. 2, no. 8, Aug. 1998.
30. Titus Lo, "Maximum Ratio Transmission", *IEEE Trans. Commun.*, vol. 47, no. 10, Oct. 1999.
31. Henry Leung, Titus Lo, and Sichun Wang, "Prediction of Noisy Chaotic time series using an optimal radial basis function neural network," *IEEE Trans. Neural Networks*, vol. 12, no. 5, Sept. 2001.

32. Titus Lo, "Adaptive space-time transmission with side information," *IEEE Trans. Wireless Communications*, Vol. 3, no. 5, Sept. 2004.

**D. REFEREED CONFERENCE/SYMPOSIUM PRESENTATIONS**

1. Titus Lo and John Litva, "Adaptive beam-space nulling of multipath signals," IEEE AP-S International Symposium, June 1988
2. Titus Lo, Jian Wang, and John Litva, "An optimization approach to pattern synthesis in the design of microstrip phased array antenna," IEEE AP-S International Symposium, June 1989.
3. Titus Lo and John Litva, "Early results of multipath measurements on Lake Ontario," IEEE AP-S International Symposium, June 1989.
4. Titus Lo, Larry Lai, and John Litva, "Multipath propagation effects on low-angle radar tracking: An experimental evaluation," IEEE AP-S International Symposium, May 1990.
5. John Litva, Titus Lo and Tim Wong, "A new technique for low-angle radar tracking", Proc IEEE Pacific Rim Conf. on Communications, Computers and Signal Processing, Victoria B. C., May 9-10, 1991 (invited).
6. Titus Lo and John Litva, "Characteristics of diffuse forward-scattering signals," Proc. IEEE IGARSS'91, Espoo, Finland, June 1991.
7. Titus Lo, John Litva, and Robert J. C. Bultitude, "High-resolution spectral analysis techniques for estimating the impulse of indoor radio channels," 1992 IEEE International Conference on Selected Topics in Wireless Communications, Vancouver, B. C., June 25-26, 1992.
8. John Litva, Titus Lo and Shen Ying, "Combining electromagnetic and digital signal processing: Moving towards the intelligent antenna," Symposium on Antenna Technology and Applied Electromagnetics, Winnipeg, MN, Aug. 5-7, 1992.
9. Titus Lo, John Litva, and Henry Leung, "Determination of optimal network structure by canonical subspace analysis," Spie's International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing, April 1993.
10. Ji Chen, Titus Lo, Henry Leung, John Litva, Albert Bridgewater, and Martin Blanchette, "A study of track initiation and the modified probabilistic data association filter for multiple target tracking using real data," Proc IEEE Pacific Rim Conf. on Communications, Computers and Signal Processing, Victoria B. C., May 9-10, 1993.
11. Ji Chen, Titus Lo, and John Litva, "Time-varying fractal surface Scattering," Progress In Electromagnetic Research Symposium, JPL, Pasadena, CA., July 1993.
12. Fengzhen Wang, Titus Lo, and John Litva, "Performance analysis of broadband adaptive digital beamforming," IEEE AP-S International Symposium, June 1993.
13. Fengzhen Wang, Titus Lo, John Litva, and William Read, "Spatio-temporal Approach for real data with multipath propagation," 1993 Canadian Conference on Electrical and Computer Engineering, Vancouver, B.C., Sept. 1993.
14. Fengzhen Wang, John Litva, and Titus Lo, "Performance of broadband adaptive digital beamforming in communications," 23rd European Microwave Conference, Madrid, Spain, Sept. 1993.
15. Fengzhen Wang, Titus Lo, John Litva, and William Read, "VHF sensor array real data processing techniques for direction finding," The international Conference on Signal Processing Applications & Technology'93, Santa Clara, CA, Sept. 1993.
16. Titus Lo, Henry Leung, W. Bridgewater, and John Litva, "Multitarget tracking initiation using a modified Hough transform," NATO Advisory Group for Aerospace Research & Development Conference Proceedings 539, Guidance and Control Panel 57th Symposium, Seattle, Washington, Oct. 12-15, 1993.
17. Fengzhen Wang, Titus Lo, John Litva, and Eloi Bosse, "Multisensor automatic target classification with neural networks," IEEE Seventh SP Workshop on Statistical Signal and Array Processing, Quebec City, June 1994.

18. Ban Quach, Henry Leung, Titus Lo, and John Litva, "Hopfield network approach to beamforming in spread spectrum communication," IEEE Seventh SP Workshop on Statistical Signal and Array Processing, Quebec City, June 1994.
19. Albert Chan, Titus Lo, and John Litva, "Detection in array receiver using radial basis function network," IEEE Seventh SP Workshop on Statistical Signal and Array Processing, Quebec City, June 1994.
20. Titus Lo, Henry Leung, John Litva, "A comparative study of statistical and neural DOA estimation Techniques," IEEE Seventh SP Workshop on Statistical Signal and Array Processing, Quebec City, June 1994.
21. Fengzhen Wang, Titus Lo, John Litva, and William Read, "High accuracy direction finding antenna array system," IEEE AP-S International Symposium, Seattle, WA, June 1994.
22. Charles Laperle, Titus Lo, and John Litva, "Modelling of nonlinearities and their effects on digital beamforming," IEEE AP-S International Symposium, Seattle, WA, June 1994.
23. Nagula Sangary, Keli Wu, Titus Lo, and John Litva, "Beamforming with spiral antennas," URSI Radio Science Meeting, Seattle, WA, June 1994.
24. Titus Lo, Fengzhen Wang, Ji Chan, Henry Leung, and John Litva, "Neural networks for Multisensor Multitarget tracking," Dedicated Conf. on Robotics, Motion, and Machine Vision, Aachen, Germany, Oct. 1994 (invited).
25. Fengzhen Wang, Titus Lo, John Litva, and Eloi Bosse, "A new energy function of mean field Hopfield network for measurement data association," 5th International Conference on Signal Processing and Technology'94, Dallas, Texas, Oct. 1994.
26. Ying Zhang, Henry Leung, Titus Lo, and John Litva, "A distributed multi-sensor multi-target tracking algorithm," Spie's International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing, April 1995.
27. Yifeng Li, Henry Leung, Titus Lo, and John Litva, "New architectures for centralized multisensor multitarget tracking," Spie's International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing, April 1995.
28. Henry Leung, Ban Quach, Titus Lo, and John Litva, "Chaotic neural beamforming for wireless communications," IEEE Pacific Rim 1995 conference, Victoria, B.C., May 1995.
29. John Litva, Anupreet Sandhu, Keizo Cho, and Titus Lo, "Adaptive beamforming for wireless communications," 5th Virginia Tech symposium on Wireless Personal Communications, Blacksburg, VA, June 1995.
30. Keizo Cho, Titus Lo, and John Litva, "BER performance comparisons between a Diversity Receiver and a LMS beamforming receiver operating with cochannel interference," Wireless'95, Calgary, Alta., July 1995.
31. Anupreet Sandhu, Titus Lo, Henry Leung, and John Litva, "Hopfield neurobeamformer for spread spectrum communications," The 6th IEEE International symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 95), Toronto, ON., Sept. 1995.
32. Wei Zhang, Titus Lo, and John Litva, "Fractal modelling of forest surface for electromagnetic wave scattering research," The 6th IEEE International symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 95), Toronto, ON., Sept. 1995.
33. Jean-Yves Carrier, John Litva, Henry Leung, and Titus Lo, "Genetic algorithm for multiple target tracking data association," Spie's International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing, April 1996.
34. Titus Lo, Henry Leung, and John Litva, "Separation of a mixture of chaotic signals," IEEE International Conference on Acoustic, Speech and Signal Processing (ICASSP'96), Atlanta, May 1996.
35. Titus Lo and John Litva, "Radarsat antenna elevation pattern restoration," IEEE AP-S International Symposium, June 1996.

36. Titus Lo, Henry Leung, and Keith Chan, "Data fusion using dynamic associative memory," Spie's International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing, April 1997.
37. Shiping He, Titus Lo, and John Litva, "Performance analysis of CDMA with an adaptive antenna array," International Wireless and Telecommunications Symposium, Shah Alam, Malaysia, May 1997.
38. Ming Lu, Titus Lo, John Litva, "A physical spatio-temporal model of multipath propagation channels," IEEE VTC, Phoenix, AZ, May 1997.
39. John Litva, Anupreet Sandhu and Titus Lo, "Adaptive beamforming for CDMA wireless communications using correlated codes," IEEE AP-S International Symposium, June 1997.
40. Ming Lu, Titus Lo, John Litva, "Downlink capacity of a cellular CDMA system configured with multibeam cell-site antenna in multipath fading channels," Wireless'97, Calgary, AB, July 1997.
41. Ming Lu, Titus Lo, and John Litva, "Effect of transmit antenna pattern on rake reception in multipath fading channels", IEEE International Conference on Universal Personal Communications (ICUPC'97), San Diego, CA, Oct. 12-16, 1997
42. Shiping He, Titus Lo, and John Litva, "A new spread spectrum system using spectral correlation technology", IEEE MILCOM'97, Monterey, CA, Nov. 2-5, 1997.
43. Shiping He, Titus Lo, and John Litva, "A spread spectrum system with a time-domain processing device", IEEE MILCOM'97, Monterey, CA, Nov. 2-5, 1997.
44. Ming Lu, Titus Lo, and John Litva, "A smart antenna array for CDMA systems with non-coherent M-ary orthogonal modulation", IEEE CLOBECOM'97, Phoenix, AZ, Nov. 4-8, 1997.
45. Donghai Qiao, John Litva, Titus Lo, and Shiping He, "Effects of frequency selective fading on performance of an adaptive antenna array", 1997 IEEE Pacific Rim Conference on Volume: 1, Page(s): 366 -369 vol.1
46. Vahid Tarokh and Titus Lo, "Principal ratio combining for fixed wireless applications when transmitter diversity is employed," IEEE ICUPC'98, Florence, Italy, Oct. 5-9, 1998.
47. Titus Lo, "Maximum Ratio Transmission," IEEE ICC'99, Vancouver, Canada, June 1999.
48. Titus Lo and Vahid Tarokh, "Space-time block coding – From a physical perspective," IEEE WCNC'99, New Orleans, LA, Sept. 1999.
49. Titus Lo, "Adaptive space-time transmission with side information" Wireless Communications and Networking, 2003. WCNC 2003. 2003 IEEE, Volume: 1, 16-20 March 2003.

#### **E. INVITED LECTURES AND SEMINARS**

1. Special guest speaker, "Propagation over Fractal Trees," Spectrum Research Seminar Series, Ministry of Industry, Canada, June 1995. (Video tape for the entire lecture is available through the Ministry)
2. Invited speaker, "Fixed Wireless Communications," AT&T Labs-Research, Nov. 1998.
3. Invited speaker, "Optimizing system capacity in wireless communications systems," IEEE Intercomm'99, Vancouver, B.C., Feb. 1999
4. Invited speaker, "IEEE802.16e: Technical Overview", Seminar at the University of British Columbia, sponsored by IEEE Joint Communications Chapter – Vancouver, July 25, 2005
5. Invited speaker, "Mobile WiMAX – Technical Overview and Market Opportunity," MITACS Seminar Series on Analog Wideband Communications, University of Calgary, Mar. 7, 2008
6. Invited speaker, "LTE – A technical overview," Seminar at University of Washington, sponsored by IEEE Seattle Communications Society Chapter, May 19, 2009
7. Invited speaker, "Key Technologies in 3.5G and 4G," IEEE Pacific Northwest Wireless Workshop 2009, Oct. 30, 2009

8. Invited speaker, "LTE – An infotainment," Seminar at Microsoft Research, sponsored by IEEE Seattle Communications Society Chapter, Sept. 30, 2010
9. Invited speaker, "LTE – An introduction," Seminar for executives at Intermec Corporation, Nov. 16, 2010
10. Invited speaker, "The "ABCs" of LTE," Seminar at Microsoft Research, sponsored by IEEE Seattle Section, May 12, 2015
11. Moderator, panel discussion, "Current State of 5G" sponsored by IEEE Seattle Communications Joint Chapter, Nov. 19, 2019