

M. Imran Hayee

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OVERVIEW: Proven leading-edge technical expert, with excellent leadership, organizational, problem-solving, and communications skills. Over 20 years of hands on experience, reinforced by solid theoretical and experimental abilities, working with communications systems and signal processing techniques. Holds 17 US patents and has published 66 research articles in renowned journals and prestigious conferences. Co-authored a book chapter. Have brought in >1M dollars in research funding to UMD from various federal, state and industrial sources. Senior Member of *IEEE*, Member *LEOS*, and *OSA*. Active reviewer of multiple journals including *IEEE's Transactions, on Communications, Journal of Lightwave Technology, Photonics Technology Letters, OSA's Journal of Optical Networking*, and *Transportation Research Board's journal of Transportation Research Record*.

EDUCATION:

Jan 1995 – Dec 1998: Ph.D. in Electrical Engineering, USC, Los Angeles, **GPA 3.96/4.00**
Advisor: **Professor Alan E. Willner**,
Thesis Topic: “**Techniques to improve system performance against fiber nonlinearities in high speed wavelength division multiplexed systems**”

Jan 1994 – Dec 1994: M.S. in Electrical Engineering, USC, Los Angeles, **GPA 3.92/4.00**
Sep 1987 – Aug 1992: B. Sc. in Electrical Engineering UET, Pakistan, **University Honors**

EXPERIENCE:

Jul 2010 – Present: **Professor, Electrical Engineering Department, University of Minnesota Duluth**

Sep 2004 – Jun 2010: **Associate Professor, Electrical Engineering Department, University of Minnesota Duluth**

Teaching: At UMD, I have taught courses related to signals and systems, communication and signal processing both at undergraduate and graduate levels. My teaching ratings have always been among the highest in the department.

Research: My main research areas are optical fiber and wireless communication systems and networks. My current research focusses on intelligent transportation systems. At UMD, I have developed a nationally recognized research program to improve traffic mobility and safety using vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) wireless communication. I have supervised one postdoctoral fellow and nine Masters students who have graduated, and currently supervising 4 more graduate students. I have also worked with many undergraduate students on various research and design projects. I take pride to co-author many peer reviewed research articles with my students and having them as co-inventors on patents.

Service: I have served the department, college and campus in a variety of roles both as a member and as a chair of many committees including Campus Climate Change Committee, Student Behavior Judiciary Committee, Campus Executive committee, College Technology Advisory Committee, Departmental Strategic Planning Committee, and a variety of Search Committees throughout the campus. I have also served the profession by being program committee members of many professional conferences, reviewer of many professional journals, and panelist of NSF Graduate Research Fellowship program for many years.

Jun 2007 – Jul 2012: **Director of Graduate Studies, Electrical Engineering Department, University of Minnesota Duluth**

I have served as the director of graduate studies in electrical engineering department for 6 years. During this time, I expanded the graduate program from 2 students to almost 20 students. During my time, there has been a significant increase in departmental funding for our graduate students both in terms of research as well as teaching assistantships. We had a successful external review of our graduate program in the year 2010-2011 in which our program was highly applauded by external reviewers.

Apr 2004 – Aug 2004: **Lead System Engineer, Opvista Inc.**
Worked on the architecture specification for the 10Gb/s systems product and set the technology direction to transition to 40Gb/s product. Also, performed experiments for the record transmission distance using 10G product with no inline amplification.

Nov 2000 – Apr 2004: **Lead Engineer, Corvis Corporation (formerly Dorsal Networks)**

Systems Research and Design

Performed a leading role in the systems research and design group focusing on the design and development of a state-of-the-art optical fiber communications product. As a Lead Engineer, supervised and directed the work of engineers and scientists (at least five were PhDs) in the Systems R&D group. The Systems R&D group was responsible for the overall technical solution of the state-of-the-art communications system. This group performed a great deal of research not only for selecting the cutting edge technologies used in all the subsystems (terminal equipment, transmission medium and amplifying units) of the product but also for optimizing the individual technologies to solve the inherent problems which would have, otherwise, prohibited them for industrial use. Besides, leading the Systems R&D group, actively worked with the network architecture group on various network aspects of the newly developed communications system and came up with novel network architecture schemes which will provide significant benefit at no extra cost in terms of availability and reliability of the wavelength division multiplexed (WDM) communications network. A total of twelve patent applications have been submitted as a result of above described work.

Proposals and White Papers

Worked as a lead technical liaison between R&D and business development teams in evaluating the industry needs in terms of cost effective and more efficient solutions for system design and network architecture. Dealt with a number of technical proposals ranging from configuring a brand new high-capacity WDM network to upgrading an existing network for more capacity and efficiency. Prepared a variety of technical documents and presentations, and authored a number of white papers describing technology and future trends in the field of optical fiber communications.

Jan 1999 – Nov 2000: ***Sr. Member of Technical Staff, Tyco Telecommunications,***
Completed various theoretical and experimental research projects both independently and in collaboration with other distinguished researchers in the department of Systems Research at Tyco Telecommunications (formerly, AT&T Submarine Systems, **Bell Laboratories**). Performed extensive computer modeling in support of the design and development of next generation wavelength division multiplexed systems carrying ultra-high data capacity through a single fiber over transoceanic distances. This work resulted in five patent applications in various fields including WDM transmitter architecture, receiver signal processing and choice of dispersion map for use in combating fiber nonlinear effects. Actively participated in high-speed WDM transmission experiments, resulting in three research papers, two were presented at the Optical Fiber Communication Conference in the year 2000 (one during the regular session and the other during the post-deadline session), and the third paper was presented at the European Conference on Optical Communications in the year 2000 as a post-deadline paper.

Jan 1995 – Dec 1998: ***Research Assistant, Dept. of EE-Systems, USC***
Actively participated in the composition of research proposals both in terms of technical writing and in terms of generating intellectual property. These efforts were successful in generating several hundred thousand dollars in research funding from the Department of Defense, National Science Foundation and various telecommunications corporations. Completed and published original research relating to a pre-dispersion compensation technique that provides significant capability for compensating the deleterious effects of fiber nonlinearities (including self- and cross-phase modulation, four wave mixing, and Raman

scattering). Proposed and experimentally demonstrated a technique to double the capacity per channel carried by a single fiber by using power unbalanced polarization division multiplexing. Performed high-speed WDM systems experiments relating to novel polarization division multiplexing techniques and dispersion compensation using nonlinearly chirped fiber Bragg gratings. This work led to one patent application and more than a dozen publications in peer-reviewed journals and conferences.

July 1996 – Jun 1997: **Research Assistant (part time), Dept. of Radiology/Neurology, USC**

Involved in an extensive research project in terms of developing a mathematical simulation model for determining blood flow and oxygen consumption in various parts of the brain (PET and MRI images were involved) in order to decipher various brain deformations. This work resulted in a submission being presented at an international conference in the field of health sciences.

Sep 1994 – May 1996: **Teaching Assistant, Department of EE - Systems, USC**

Served as a teaching assistant for various undergrad and graduate level courses. Duties included holding office hours, delivering weekly lectures, helping students with their lab assignments, organizing and grading homework and exams. The courses for which most of these duties were performed included a senior level undergraduate course, (*Computer Architecture and Design*), and two graduate courses (*Advanced Communications Systems* and *Optical Fiber Communications*).

Sep 1994 – May 1995: **Instructor, Department of Information Sciences, USC**

Taught a senior level undergraduate course on the Unix operating system while working as an instructor for the department of information sciences during the academic year 1994-1995 (two consecutive semesters). More than 50 people attended this course representing a mix of undergraduate, graduate and industry students. The topics covered, included both operation as well as shell programming in the Unix operating system. For this course, a two-hour weekly lecture was conducted using slide presentations and a two-hour lab class was arranged every week to help students complete their homework assignments.

Sep 1992 – Nov 1993: **Instructor, Petroman Training Institute, Islamabad, Pakistan**

Taught various courses on the topics of computer hardware and electronics to undergraduate students. The specific courses taught were *Computer Hardware and Assembly Language* and *Basic Electrical Engineering and Electronics*. Prepared the full syllabus for these courses as well as helped organize the curriculum for the three-year diploma offered by Petroman Training Institute. In addition to teaching duties, arranged academic and non-academic competitions between the students to promote a healthy learning environment.

LIST OF ISSUED PATENTS:

1. **Hayee**; M. Imran, Ibrahim; Umair, Kwon; Eil ” DSRC-equipped portable changeable sign”, patent no. 10,026,313, July 17, 2018.
2. **Hayee**; M. Imran, Ibrahim; Umair, ”Vehicle-to-vehicle congestion monitoring using ad hoc control”, patent no. 9,852,637, Dec 26, 2017.
3. **Hayee**; M. Imran, Haddad; Rami, ”Optical communication system having enhanced spectral efficiency using electronic signal processing”, patent no. 8,478,131, July 2, 2013.
4. **Hayee**; M. Imran, Ahmed; Nisar, “Electronic compensation of nonlinearity in optical communication”, patent no. 8,478,136, July 2, 2013.
5. **Hayee**; M. Imran, Haddad; Rami,” Optical communication system having enhanced spectral efficiency using electronic signal processing”, patent no. 7,747,172, June 29, 2010.
6. Bergano; Neal S., Pilipetskii; Alexei N., **Hayee**; M. Imran, “Optical transmission system using optical signal processing in terminals for improved system performance”, patent no. **7,336,908**, February 26, 2008.
7. **Hayee**; M. Imran, “Asynchronous chirped systems, apparatuses, and methods”, patent no. **7,260,332**, issued on August 21, 2007.
8. **Hayee**; M. Imran, Pedersen; Bo, Pilipetskii; Alexei N., Lenner; Gerald E., “Multiple detector decision receiver” patent no. **7,209,671**, issued on April 24, 2007.
9. Bergano; Neal S., Pilipetskii; Alexei N., **Hayee**; M. Imran, “Optical transmission system using optical signal processing in terminals for improved system performance”, patent no. 7,203,429, April 10, 2007.
10. **Hayee**; M. Imran, “Electronic RZ/CSRZ signal generation for optical communication systems”, patent no. **6,980,746**, issued on December 27, 2005.
11. Feinberg; Lee Daniel, Pedersen; Esman; R. D., Bo, Hagopian; John, Mahon; Cathal, Miller; Brent Ashley, **Hayee**; M. Imran, Johnson; Ronald E., Ramanujam; Nandakumar, “Split redundant trunk architecture using passive splitters and path switching”, patent no. **6,934,469**, issued on August 23, 2005.
12. Dennis; Michael L., **Hayee**; M. Imran, Mahon; Cathal, Pedersen; Bo, Ramanujam; Nandakumar, Shieh; William, “Method and system for dispersion maps and enhanced distributed gain effect in long haul telecommunications using distributed and remotely pumped erbium-based amplification” patent no. **6,850,677**, issued on Feb. 1, 2005.
13. **Hayee**; M. Imran., Cardakli; Mustafa C., and Willner; Alan E., “Polarization division multiplexing based on power encoding of two different polarizations channels” patent no. **6,714,742**, issued on March 2 2004.
14. Dennis; Michael L., **Hayee**; M. Imran, Mahon; Cathal, Pedersen; Bo, Ramanujam; Nandakumar, Shieh; William, “Method and system for dispersion maps and enhanced distributed gain effect in long haul telecommunications” Patent no. **6,633,712**, issued on Oct 14, 2003.
15. **Hayee**; M. Imran, Shieh; William, and Wang; Quan Zhen, “Methods and systems for high performance, wide bandwidth optical communication systems using Raman amplification” Patent no. **6,614,586**, issued on Sep. 6, 2003.
16. Pilipetskii; Alexei N., Bergano; Neal, **Hayee**; M. Imran, and Pedersen; Bo, “Method and apparatus for the optimization of dispersion map using slope-compensating optical fibers”, Patent no. **6,584,262**, issued on June 24, 2003.
17. Feinberg; Lee Daniel, Pedersen; Bo, Hagopian; John, Mahon; Cathal, Miller; Brent Ashley, **Hayee**; M. Imran, Johnson; Ronald E., Ramanujam; Nandakumar, “Split redundant trunk architecture using passive splitters and path switching”, patent no. **6,556,319**, issued on April 29, 2003.

PEER REVIEWED CONFERENCE AND JOURNAL PUBLICATIONS:

- 1) Mohammad Faizan, Shah Hussain and M.I. **Hayee**, “Design and development of in-vehicle lane departure warning system using global positioning system receiver”, *Transportation Research Record, Journal of Transportation Research Board*, I-9, 2019.
- 2) Mohammad Faizan, Shah Hussain and M.I. **Hayee**, “Design and development of in-vehicle lane departure warning system”, Proceedings of *Transportation Research Board’s 98th Annual Meeting*, January 13 – 17, 2019, Washington, D.C.
- 3) Shah Hussain, M Faizan, and M. I. Hayee, “Real-Time Relative Lane and Position Identification of Surrounding Vehicles Using GPS and DSRC Based Vehicle-to-Vehicle Communication”, in Proceedings of 2018 *IEEE International Conference on Communications*, ICC 2018, Kansas City, MO, May 20-24, 2018.
- 4) Zhiyuan Peng, Shah Hussain, M. I. **Hayee**, and Max Donath, “Acquisition of Relative Trajectories of Surrounding Vehicles using GPS and DSRC based V2V Communication with Lane Level Resolution”, In Proceedings of the 3rd International Conference on Vehicle Technology and Intelligent Transport Systems (VEHITS 2017), pages 242-251.
- 5) Attiq Uz Zaman and M.I. **Hayee**, Sean Mooney, Navin Katta, “Traffic information system to deliver in-vehicle messages on pre-defined routes using DSRC based V2V communication”, *Transportation Research Record, Journal of Transportation Research Board*, No. 2559, pages 73-80, November 2016.
- 6) Mohammad Yousaf Hamza and M. I. **Hayee**, “Performance Improvement of 40 Gb/s WDM Systems by Optimization of Dispersion Map”, Proceedings of *10th International Conference on Application of Information and Communication Technologies (AICT 2016)*", held at Baku, Azerbaijan, October 12-14, 2016.
- 7) Qun Zhang, M. I. **Hayee**, Danyang Huang, Siva Nadimpalli, Lian Jie, Vincent Winstead, and Muhammad Khaliq, “Application of local error method to SSSF simulation of vector propagation in dispersion compensated optical links”, *Springer Journal Photonic Network Communications*, Vol. 32, Issue 2, pages 88-196, October 2016.
- 8) U Ibrahim, M. I. **Hayee**, Eil Kwon, and Max Donath, “Development of a Freeway Queue Detection and Warning System using Ad-hoc Control and DSRC based V2V Communication”, *Bentham’s Journal on Recent Advances in Communication and Networking Technologies*, vol. 4, no. 2, pages 103 – 116, April 2016.
- 9) Nazanin Abbaszadeh Banaeiyan, Attiquz Zaman and M.I. **Hayee**, “Visual warning system for workers’ safety on roadside work zones”, Proceedings of *Transportation Research Board’s 95th Annual Meeting*, January 10 – 14, 2016, Washington, D.C.
- 10) Attiq Uz Zaman and M.I. **Hayee**, Sean Mooney, Navin Katta, “Traffic information system to deliver in-vehicle messages on pre-defined routes using DSRC based V2V communication”, Proceedings of *Transportation Research Board’s 95th Annual Meeting*, January 10 – 14, 2016, Washington, D.C.
- 11) Qun Zhang, Liudong Xing, Hyekyung Min, **M.I. Hayee**, “Analytical Step-Size Selection Rule for Simulation of Signal Propagation in Vector Optical Fiber Channel” in the proceedings of joint *OSA/IEEE’s Conference on Lasers and Electro-optics 2015*, May 10-15, San Jose, CA.
- 12) Q. Zhang, S. Karri, M. Khaliq, L. Xing, and **M. I. Hayee**, “Global Simulation Accuracy Control in the Split-Step Fourier Simulation of Vector Optical Fiber Communication Channel”, *ETP’s Journal of Communications (JCM)*, vol. 10, no. 1, pages 1-8, January 2015.

- 13) U. Ibrahim, **M.I. Hayee**, and Eil Kwon. "DSRC Based Hybrid Work Zone Information System with Portable Changeable Message Signs", *Transportation Research Record, Journal of Transportation Research Board*, No. 2380, pages 29-35, 2013.
- 14) U. Ibrahim, **M.I. Hayee**, and Eil Kwon. "DSRC Based Hybrid Work Zone Information System with Portable Changeable Message Signs", Proceedings of *Transportation Research Board 92nd Annual Meeting*, January 13-17, Washington, D.C. 2013.
- 15) Buddhika Maitipe, U Ibrahim, M.I. **Hayee**, and Eil Kwon, "DSRC-Based V2V-Assisted V2I Work Zone Traffic Information System", *Transportation Research Record, Journal of Transportation Research Board*, No. 2324, pages 125 - 132, 2012.
- 16) Buddhika Maitipe, U Ibrahim, M.I. **Hayee**, and Eil Kwon, "Development and Field Demonstration of DSRC-Based V2I Work Zone Traffic Information System with V2V Assistance", Proceedings of *Transportation Research Board's 91st Annual Meeting*, January 22 – 26, 20112, Washington, D.C.
- 17) Buddhika Maitipe, M.I. **Hayee**, and Eil Kwon, "Vehicle-to-Infrastructure Traffic Information system for the Work Zone Based on Dedicated Short-Range Communication", *Transportation Research Record, Journal of Transportation Research Board*, No. 2243, pages 67 - 73, 2011.
- 18) Nisar Ahmad, and M. I. **Hayee**, "Electronic Compensation of Optical Fiber Nonlinearity for Intensity and Phase Modulated WDM Transmission Systems", *Bentham's Journal on Recent Patents and Signal Processing*, Vol. 1, No. 3, pages 116 – 123, 2011.
- 19) W. Ahmad, M.I. **Hayee**, J.L. Fitzakerley, S. Burns and G. Nordehn, "Heart murmur detection/classification using Cochlea-Like Pre-Processing and Artificial Intelligence", *Int. J. Biomedical Engineering and Technology*, Vol. 7, No. 1, 2011.
- 20) A. E. Willner, Z. Pan, and M. I. Hayee, "Major Accomplishments in 2010 on Optical Fiber Communications", *IEEE's Photonics Journal*, vol. 3, no. 2, pages 320 – 324, April 2011.
- 21) Buddhika Maitipe, M.I. **Hayee**, and Eil Kwon, "Development and Field Demonstration of DSRC-Based V2I Traffic Information System for the Work Zone", Proceedings of *Transportation Research Board's 90th Annual Meeting*, January 23 – 27, 2011, Washington, D.C.
- 22) Nisar Ahmed and M. I. Hayee, "Electronic Post-compensation of Fiber Nonlinearity for 40 Gb/s RZ-DPSK WDM", *23rd Annual IEEE's Photonics Society Meeting*, Denver, Colorado, November 07-11, 2010.
- 23) Nisar Ahmed and **M. I. Hayee**, and Q. Zhang "Electronic Post-compensation of Fiber Nonlinearity for 40 Gb/s WDM Systems", *Joint IEEE and OSA's Journal of Optical Communications and Networking*, vol. 2, no. 7, pages 456 – 462, July 2010.
- 24) Q. Zhang, C. R. Menyuk, R. Bajracharya, **M. I. Hayee**, H-W. Huang, and A. Miner "On the Gaussian Approximation and Margin Measurements for Optical DPSK Systems with Balanced Detection," *Joint OSA/IEEE's Journal of Lightwave Technology*, vol. 28, no. 12, Jun. 2010, pages 1752 – 1760.
- 25) Nisar Ahmed and **M. I. Hayee**, "Electronic Compensation of Fiber Nonlinearity for 40 Gb/s WDM Transmission Systems", *22nd Annual IEEE's Photonics Society Meeting*, Belek-Antalya, Turkey, October 04-08, 2009
- 26) Nisar Ahmed and **M. I. Hayee**, "Electronic Compensation of Optical Fiber Nonlinearity in On-Off Keyed 40 Gb/s WDM Transmission Systems", *Conference on Frontiers in Optics 2009 / Laser Science XXV*, San Jose, CA, October 11-15, 2009
- 27) W. Ahmad, **M. I. Hayee**, J. Fitzakerley, S. Burns, and G. Nordehn, "Variable Self-Optimizing Cochlear Model for Heart Murmur Detection/Classification" *DMD Conference 2009*, Minneapolis, MN, April 14-16, 2009. Abstract published in *ASME's Journal of Medical Devices*, vol. 3, June 2009, page 027541-1.

- 28) Z. Tridane, X. Yu, **M. I. Hayee**, G. Nordehn, J. Fitzakerley, "Development of an Animal Model to Test an Active Noise Cancellation System for Infant Incubators", DMD Conference 2009, Minneapolis, MN, April 14-16, 2009. Abstract published in *ASME's Journal of Medical Devices*, vol. 3, June 2009, page 027530-1.
- 29) Q. Zhang, C. R. Menyuk, **M. I. Hayee**, C. Tavva, H.-W. Huang, R. Nair and M. Khaliq, "Computation step-size study in digital post-compensation of fiber optic communication systems," Proc. 43th Annual Conf. Information Sciences and Systems (CISS), Baltimore, MD, March 2009, Session FA4: Communication Systems.
- 30) Q. Zhang, **M. I. Hayee**, C. Ma, M. Howieson, A. Rahman, A. Miner, R. Kapadia, C. Tavva, R. Bajracharya, and H.-W. Huang, "On the Gaussian approximation and margin measurements in optical amplifier systems," Proc. 43th Annual Conf. Information Sciences and Systems (CISS), Baltimore, MD, March 2009, Session FA4: Communication Systems.
- 31) W. Ahmad, M. I. **Hayee**, Glenn Nordehn, Stan Burns and J. L. Fitzakerley, "Heart Murmur Detection/Classification System using Cochlea-like Pre-processing", *Seventh Annual Design of Medical Devices Conference*, 2008, April 15-17, 2008, Minneapolis, MN. Abstract published in *ASME's Journal of Medical Devices*, vol. 8, June 2008, page 027531-1.
- 32) Abhijeet Shirgurkar, and M. I. **Hayee**, "Transoceanic Networks for 44 Gb/s WDM Transmission using $\pi/2$ Alternate-Phase RZ Modulation Format", *ISAST Transactions on Communications and Networking*, vol. 2, no. 1, 2008, pages 36 - 41.
- 33) Abhijeet Shirgurkar, Q. Zhang, and M. I. **Hayee** "Performance Comparison for APRZ on Strongly and Weakly Managed Dispersion Maps for 40 Gb/s WDM Transmission" *International Journal of Performability Engineering*, vol. 4, no. 2, April 2008.
- 34) Q. Zhang, and M. I. **Hayee**, "Symmetrized Split-Step Fourier Scheme to Control Global Simulation Accuracy in Fiber-Optic Communication Systems", joint *OSA/IEEE's Journal of Lightwave Technology*, vol. 26, no. 2, Jan. 2008, pages 302 – 316.
- 35) Abhijeet Shirgurkar and M. I. **Hayee**, "44 Gb/s WDM Transmission for Transoceanic Distance using p/2 Alternate-Phase RZ Modulation Scheme", in *Conference on Optical Fiber Communications 2007*, Paper JWA45, Anaheim, CA, March 2007.
- 36) M. I. **Hayee** and Rami Haddad, "Enhancing spectral efficiency of binary NRZ optical networks with electronic signal processing", *OSA Journal of Optical Networking*, vol. 5, no. 9, Sep. 2006, pages 655 – 661.
- 37) Rami Haddad and M. I. **Hayee**, "Spectral Efficiency of up to 1.6 bit/sec/Hz in Binary NRZ WDM Systems using Electronic Signal Processing", in *Conference on Lasers and Electro-Optics 2006*, Long Beach California, May 21 – 26.
- 38) M. I. **Hayee** and Qun Zhang, "40Gbits/s Metropolitan Networks using Power Unbalanced Polarization Division Multiplexing", *OSA Journal of Optical Networking*, vol. 5, no. 5, May 2006.
- 39) Qun Zhang, and M. I. **Hayee**, "An SSF Scheme to Achieve Comparable Global Simulation Accuracy in WDM Systems", *IEEE Photonics Technology Letters*, vol. 17, no. 9, Sep. 2005.
- 40) Q. Zhang, L. Xing, M. Cheng, M. I. **Hayee**, "Achieving Comparable Global Accuracy in the Split-Step Fourier Simulation of Optical Fiber Communication Channel", 2005 Digest of the IEEE/LEOS Summer Topical Meetings, IEEE/LEOS Summer Topical Meetings 2005, 25 - 27 July 2005, San Diego, CA.
- 41) M. I. **Hayee**, and Rami Haddad, "Chirped RZ-DPSK Modulation Format in 40Gb/s WDM Transmission Systems", in *Conference on Lasers and Electro-Optics 2005*, Baltimore, Maryland, May 22-27.
- 42) M. I. **Hayee**, M. C. Cardakli, A. B. Sahin, and A. E. Willner, "Doubling of bandwidth utilization using two orthogonal polarizations and power unbalancing in a polarization division multiplexing scheme", *IEEE Photonics Technology Letters*, vol. 13, no. 8, August 2001.

- 43) D. Gurkan; M. I. **Hayee**.; A. E. Willner, “Transient behavior of L-band and C-band EDFAs in an add/drop multiplexed 40-channel WDM network” in *Conference on Lasers and Electro-Optics, 2001. CLEO '01*.
- 44) R. Khosravani, S. Lee, M. I. **Hayee** and A. E. Willner, “Soliton sampling of subcarrier multiplexed signals to suppress dispersion induced RF power fading”, *IEEE Photonics Technology Letters*, vol. 12, no. 9, September 2000.
- 45) H. Sun, M. C. Cardakli, K. –M. Feng, J. –X. Cai, H. Long, M. I. **Hayee** and A. E. Willner, “Tunable RF-power-fading compensation of multiple-channel double-sideband SCM transmission using a nonlinearly chirped FBG”, *IEEE Photonics Technology Letters*, vol. 12, no. 5, May 2000.
- 46) N. Ramanujam, A. B. Puc, G. Lenner, H. D. Kidorf, C. R. Davidson, M. I. **Hayee**, J. –X. Cai, M. Nissov, A. Pilipetskii, C. Rivers, N. S. Bergano, “Forward error correction (FEC) techniques in long-haul optical transmission systems”, in Lasers and Electro-Optics Society’s 13th Annual Meeting. Volume: 2 , 2000.
- 47) J.-X. Cai, M. I. **Hayee**, M. Nisov, M. A. Mills, A. N. Pilipetskii, S. G. Evangelides Jr., N. Ramanujam, C. R. Davidson, R. Menges, P. C. Corbett, D. Sutton, G. Lenner, C. Rivers, N. S. Bergano, “1.12 Tb/s Transmission over trans-Atlantic Distance (6,200km) using fifty six 20 Gb/s channels”, in *European Conference on Optical Communications 2000*, Postdeadline Session, Paper 1.6, Munich, Germany.
- 48) M. Nissov, J.-X. Cai, M. I. **Hayee**, A. N. Pilipetskii, S. G. Evangelides Jr., B. Pedersen, N. Ramanujam, C. R. Davidson, C. J. Chen, M. A. Mills, R. Menges, P. C. Corbett, C. Rivers, and N. S. Bergano, “32x20 Gb/s Transmission over transatlantic distance (6,200 km) with 31% spectral efficiency”, in *Conference on Optical Fiber Communications 2000*, Postdeadline Session., Paper PD30, Baltimore, Maryland, March 2000.
- 49) C. R. Davidson, C. J. Chen, M. Nissov, A. Pilipetskii, N. Ramanujam, H. D. Kidorf, B. Pedersen, M. A. Mills, C. Lin, M. I. **Hayee**, J. X. Cai, A. B. Puc, P. C. Corbett, R. Menges, H. Li, A. Elyamani, C. Rivers, N. Bergano, “1800 Gb/s transmission of one hundred and eighty 10Gb/s WDM channels over 7,000 km using full EDFA C-band”, in *Conference on Optical Fiber Communications 2000* Postdeadline Session Paper PD25, Baltimore, Maryland, March 2000.
- 50) H. Kidorf, N. Ramanujam, M. I. **Hayee**, M. Nissov, J. X. Cai, B. Pedersen, A. Puc, and C. Rivers, “Performance improvement in high capacity, ultra-long distance, WDM systems using forward error correction codes”, in *Conference on Optical Fiber Communications 2000*, Paper ThS3, Baltimore, Maryland, March 2000.
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- 52) O. H. Adamczyk, M. C. Cardakli, J. –X. Cai, M. I. **Hayee**, C. Kim and A. E. Willner, “Coarse and fine bit synchronization for WDM interconnections using two subcarrier-multiplexed control pilot tones”, *IEEE Photonics Technology Letters*, vol. 11, no. 8, August 1999.
- 53) M. I. **Hayee**, and A. E. Willner, “Transmission penalties due to EDFA gain transients in add-drop multiplexed WDM networks”, *IEEE Photonics Technology Letters*, vol. 11, no. 7, July 1999.
- 54) K. M. Feng, J. X. Cai, V. Grubsky, D. S. Starodubov, M. I. **Hayee**, S. Lee, X. Jiang, A. E. Willner, and J. Feinberg, “Dynamic dispersion compensation in a 10-Gb/s optical system using a novel voltage tuned nonlinearly chirped fiber bragg grating”, *IEEE Photonics Technology Letters*, vol. 11, no. 3, March 1999.
- 55) R. Khosravani, M. I. **Hayee**, B. Hoanca, and A. E. Willner, “Reduction of coherent crosstalk in WDM add-drop multiplexing nodes by bit pattern misalignment”, *IEEE Photonics Technology Letters*, vol. 11, no. 1, January 1999.
- 56) H. Sun, M. C. Cardakli, K. –M. Feng, J. –X. Cai, H. Long, M. I. **Hayee** and A. E. Willner, “Tunable RF-power-fading compensation of multiple-channel double-sideband SCM transmission using a nonlinearly chirped FBG”, in *Conference on Lasers and Electro-Optics '99*, Paper CWK1, Baltimore, MD, 1999.

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- 58) M. I. Hayee, "Techniques to improve system performance against fiber nonlinearities in high speed wavelength division multiplexed systems", Ph. D. dissertation in *University of Southern California, Los Angeles, CA* in December 1998.
- 59) R. Khosravani, S. Lee, M. I. Hayee and A. E. Willner, "Soliton sampling of subcarrier multiplexed signals to suppress dispersion induced RF power fading" in *Conference on Optical Fiber Communications '98* Tech. Dig., Paper ThW4 San Jose, CA, Feb. 1998.
- 60) M. I. Hayee, and A. E. Willner, "Transmission penalties due to EDFA gain transients in add-drop multiplexed WDM networks", " in *Conference on Optical Fiber Communications '98* Tech. Dig., Paper ThU4 San Jose, CA, Feb. 1998.
- 61) M. I. Hayee, and A. E. Willner, "NRZ vs. RZ in high-speed, dispersion-managed WDM systems", in *Conference on Optical Fiber Communications '98* Tech. Dig., Paper FE2 San Jose, CA, Feb. 1998.
- 62) M. I. Hayee, and A. E. Willner, "Pre- and post-compensation of dispersion and nonlinearities in 10 Gb/s WDM systems", *IEEE Photonics Technology Letters*, vol. 9, no. 9, 1997.
- 63) M. I. Hayee, and A. E. Willner, "Effects of randomness of dispersion-zero wavelength and relative channel location in high-speed WDM systems", in *Conference on Lasers and Electro-Optics '97*, CTuV6, 1997.
- 64) T. Sangsiri, M. I. Hayee, B. Hoanca, W. Shieh, A. E. Willner, "Stability and dynamic range of a Mach-Zehnder wavelength shifter", in *Conference on Optical Fiber Communications '97* Tech. Dig., dallas, Texas, Feb. 1997.
- 65) M. I. Hayee and A. E. Willner, "Precompensation of dispersion and nonlinearities in 10 and 20 Gbit/s WDM systems", in *Conference on Optical Fiber Communications '97* Tech. Dig., dallas, Texas, Feb. 1997.
- 66) X. Y. Zou, M. I. Hayee, S-. M. Huwang, and A. E. Willner, "Limitations in 10 Gb/s WDM optical-fiber transmission when using a variety of fiber types to manage dispersion and nonlineariteis", *IEEE/OSA Journal of Lightwave Technology*, Special issue on multiple wavelengths and Networks, vol. 14, no4, 1996.
- 67) M. I. Hayee, X. Y. Zou, and A. E. Willner, "Degradations due to both dispersion and SPM.CPM in dispersion-managed WDM long-distance systems", in *Conference on Optical. Fiber Communications '96* Technical. Digest., San Jose, CA, Feb. 1996, paper TuN7.

OTHER SIGNIFICANT PUBLICATIONS:

1. M Faizan, Shah Hussain and M. I. Hayee, "Development and Demonstration of a Cost-Effective In-Vehicle Lane Departure and Advanced Curve Speed Warning System", a comprehensive research report on a project funded by MnDoT, peer reviewed and published by Research Services and Library of Minnesota Department of Transportation, Dec 2019.
2. Nazanin A Banaeiyan, and M. I. Hayee, "Visual Warning System for Worker Safety on Roadside Work-zones", a 45 page comprehensive research report on a project funded by MnDoT, peer reviewed and published by Research Services and Library of Minnesota Department of Transportation, August 2016.
3. Umair Ibrahim, and M. I. Hayee, "Development of Hybrid DSRC-PCMS Information System for Snowlow Operations and Work Zones" a 25 page comprehensive research report on a project funded by NASTRL, peer reviewed and published by Institute of Transportation Systems, University of Minnesota, January 2013.

4. Buddhika Maitipe, Umair Ibrahim, and M. I. Hayee, "Development and Field Demonstration of DSRC-Based V2V – Assisted Traffic Information System for the Work Zone" a 30 page comprehensive research report on a project funded by NASTRL, peer reviewed and published by Institute of Transportation Systems, University of Minnesota, August 2012.
5. Book Chapter: "Gaussian Approximation and Margin Measurements for Amplified Optical Fiber Systems" by Qun Zhang, Ram Bajracharya, Han-Way Huang, Erik Morness, and M. I. Hayee. Book Title: *Advances in Optical Amplifiers*, ISBN: 978-953-7619-X-X – to be published by InTech Publishing. Accepted for publication.
6. Buddhika Maitipe, M. I. Hayee, "Development and Field Demonstration of DSRC-Based V2I Traffic Information System for the Work Zone" a 40 page comprehensive research report on a project funded by NASTRL, peer reviewed and published by Institute of Transportation Systems, University of Minnesota, December 2010.
7. Roodell, Beau, M. I. Hayee, "Development of a Low-Cost Interface between Cell Phones and DSRC-Based Vehicle Unit for Efficient Use of VII Infrastructure", a 50 page comprehensive research report on a project funded by NASTRL, published by Institute of Transportation Systems, University of Minnesota, November 2009.
8. A poster was presented in the *Conference on Biomedical Instrumentation* held in University of Minnesota, Twin Cities Campus in April 2006 as a result of guiding a class project to a student. The title of the abstract was "Automated detector of S1, S2, S3 and S4". The co-authors were Adilbek Karaguishiyev, Spencer Strunic, Glenn Nordehn, Stanley Burns and Fernando Rios-Gutierrez.
9. A research article, "The 40 Gbit/sec Crystal Ball", for non-technical readers was published in Spring 2005 issue of *Gateway to Research and Inventions*, publication of the Office of the Vice President for Research, University of Minnesota.
10. A poster was presented in the *Conference on Biomedical Instrumentation* held in University of Minnesota, Twin Cities Campus in April 2005 as a result of senior design project by a team of three students. The title of the abstract was "*Electronic Stethoscope with Diagnostic Capabilities*". The co-authors were Alan Arends, Adilbek Karaguishiyev, Spencer Strunic and Marian Stachowicz.

INVITED TALKS:

1. "Design and Development of In-vehicle Lane Departure Warning System using Standard GPS Technology", *Center of Transportation Annual Research Conference 2018*, Twin Cities Campus, Nov 1, 2018.
2. "An Innovative Design of an In-vehicle Lane Departure Warning System", *Towards Zero Death Conference 2018*, Mankato, Minnesota, Oct 23-24, 2018.
3. "Design and Development of In-vehicle Lane Departure Warning System using Standard GPS Technology", *Roadway Safety Institute*, University of Minnesota, Twin Cities Campus, May 3, 2018.
4. "Connected Vehicle Technology: What, Why and How?", *International Conference on Information and Communication Technologies*, Karachi, Dec. 30-31, 2017.
5. "Development of an Innovative Lane Departure Warning System?", IEEE's *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 18 - 20, 2017.
6. "Connected Vehicle Technology: What, Why and How?", Colloquium Seminar, ECE Department, Twin Cities, March 2, 2017.
7. "Connected Vehicle Technology: What, Why and How?", Comsats Institute of Technology, Wah Campus, Pakistan, December 22, 2016.
8. "Dedicated Short Range Communication: What, Why and How?", IEEE's *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 19 - 21, 2016.

9. "Connected and Automated Vehicles Technology", as a panelist in an interactive session at the *Annual Research Conference of CTS*, November 3, 2016.
10. "Dedicated Short Range Communication: What, Why and How?", *Roadway Safety Institute*, University of Minnesota, Twin Cities Campus, October 27, 2016.
11. "A worker Safety System using DSRC communication", presented to CTS-MnDOT Office of Traffic, Safety, and Technology Partnership, September 7, 2016.
12. "Exploiting Relative GPS accuracy to improve transportation safety", IEEE's *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 14 - 16, 2015.
13. "Optical fiber – enabler of wireless devices in the palms of your hands", *International Conference on Information and Communication Technologies*, Karachi, Dec. 12-13, 2015.
14. "Freeway merge assist system using DSRC based V2V communication" *6th annual research conference of University of Minnesota's Center of Transportation Studies*, May 20-21, 2015.
15. "Design and Development of Traffic Information System using V2V Communication", IEEE's *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 16 - 18, 2014.
16. "Improving Traffic Safety and Mobility Using DSRC-Based V2V Communication", *Roadway Safety Institute*, University of Minnesota, Twin Cities Campus, December 4, 2014.
17. "Optical Fiber – Enabler of wireless devices in the palms of your hands", IEEE's, *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 16 - 18, 2013.
18. "Improving Road Safety and Mobility using DSRC based V2V and V2I technology", *IEEE Arrowhead Chapter*, Duluth, MN, Nov. 14, 2013
19. "Making roads safe using DSRC based vehicle-to-vehicle and vehicle-to-infrastructure communication", *BIT's 2nd Annual World Congress of Emerging Info-Tech*, Dalian, China, June 20 – 22, 2013.
20. "Use of Connected Vehicles Technologies for Work Zone Mobility and Safety", *Federal Highway Administration Authority's Work Zone Performance Management Peer Exchange Workshop*, Atlanta, GA, May 8, 2013.
21. "Traffic Information System using DSRC based V2V and V2I communication for Work Zone Environment", *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 17 - 19, 2012.
22. "Development and Field Demonstration of Dedicated Short-Range Communication-Based Vehicle-to-Infrastructure assisted V2V traffic information system for work zone", presented at *18th Annual Meeting and Information Exchange of Institute of Intelligent Transportation Systems*, on March 14, 2012.
23. "V2I-Assisted V2V DSRC Based Traffic Information System for Work Zone Environment", at the ITS Institute, University of Minnesota Twin Cities on October 27, 2011.
24. "Early Heart Murmur Detection using Human Cochlea like signal processing and Artificial Neural Networks", presented at the East Kazakhstan Technical State University on May 20, 2011.
25. "How to make US Roadways safer using Intelligent Transportation Systems", presented at the East Kazakhstan Technical State University on May 19, 2011.
26. "DSRC Based V2I and V2V Traffic Information Applications for Congested US Roadways" to be presented in Workshop at *Transportation Research Board's 90th Annual Meeting*, January 23 – 27, 2011, Washington, D.C.
27. "How traffic bottlenecks can be avoided using wireless communication", *International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, on December 21 - 23, 2010
28. "How good engineering design can help doctors diagnose better", in All Pakistan Digital Innovation Competition and Exhibition (DICE) held in Lahore, Pakistan on December 23-24, 2009.
29. "Heart Murmur Detection and Classification Using Cochlea Like Signal Processing", in *International Conference on Frontiers of Information Technology*, held in Abbottabad, Pakistan, on December 16-18, 2009.
30. "Mining the Optical Fiber Bandwidth via Electrical Signal Processing" in 6th International Workshop on *Frontiers in Information Technology*, organized by Comsat Institute of Information Technology and Pakistan Higher Education Commission, held in Islamabad, Pakistan on Dec. 18-19, 2008.

31. "A high level overview of high capacity long-haul optical fiber communications systems", in the department of Electrical and Computer Engineering of the City University of New York on Dec 19, 2005.
32. "High-spectral-efficiency long-haul systems" in *OECC/IOOC* held on July 1-5, 2001 in Sydney, Australia.
33. "EDFA power transients and their effects in high speed optical networks" in *Lasers and Electro-Optics' 12th Annual Meeting* held on Nov 8-11, 1999 in San Francisco, California, USA.
34. "Power unbalanced polarization division multiplexing for efficient bandwidth utilization" in *Conference on Lasers and Electro-Optics* held on May 23-28, 1999 in Baltimore, Maryland, USA.

RESEARCH GRANTS:

1. Minnesota Department of Transportation and LRRB, "Lane Departure and Advanced Curve Speed Warning System using DSRC based V2V communication", July 1, 2018 to Feb 28, 2021, PI: M. I. Hayee, Funded amount: \$133,600.
2. Minnesota Department of Transportation and LRRB, "Cost Effective In-vehicle Lane Departure and Advanced Curve Speed Warning System", April 2016 to June 2018, PI: M. I. Hayee, Funded amount: \$124,500.
3. US Department of Transportation, "Real time processing of vehicles' relative trajectories acquired via DSRC-based V2V communication for freeway merge applications", The 2nd phase of UTC grant which was originally for two years. July 2016 to Dec. 2017, PI from UMD: M. I. Hayee. Funded amount: \$91,000.
4. US department of Transportation, "Acquisition of real-time relative vehicle trajectories to facilitate freeway merging using DSRC based V2V communication", University of Minnesota was the lead university to win the Regional University Transportation Center (UTC) grant from US Department of Transportation. The total amount of funding is \$2.5M for two years, from June 2014 to May 2016. PI from UMD: M. I. Hayee. Funded amount: \$184,000.
5. US Department of Transportation, "Delivering In-Vehicle Messages in Temporary Work Zones", a Small Business Innovative Research (SBIR) research project in collaboration with Savari Networks. The project will be conducted from August 2014 to June 2016. The total federal funding for this project is \$750,000 from which UMD's share is \$145,000.
6. Minnesota Department of Transportation, "DSRC Based Warning System for Workers Safety", April 2014 to June 2016, PI: M. I. Hayee, Funded amount: \$129,341.
7. Minnesota Department of Transportation and Institute of Intelligent Transportation, 12-13, "Development of Hybrid DSRC-PCMS Work Zone Information System Using DSRC based V2V communications", September, 1, 2012 – Dec. 31, 2013, PI: M. I. Hayee, Funded amount: \$50,000.
8. NASTRL 11 -12, "Snowplow Warning System for Drivers using V2V and V2I based DSRC Communication and Variable Message Signs (VMSs)", July 1, 2011 - June 30, 2012, PI: M. I. Hayee, Funded amount: \$61,463.
9. Chancellor's small grants, Fall 2010, PI: M. I. Hayee. Funded amount: \$750.
10. NASTRL 10 -11, "Development of a Portable Work Zone Traffic Information System using DSRC based Vehicle to Vehicle (V2V) communication to enhance range and congestion coverage length", July 1, 2010 - June 30, 2011, PI: M. I. Hayee, Funded amount: \$59,710.
11. NASTRL 09 -10, "Development of a Portable Work Zone Traffic Information System using DSRC based Vehicle to Infrastructure (V2I) communication", July 1, 2009 - June 30, 2010, PI: M. I. Hayee, Funded amount: \$62,000.
12. Chancellor's small grants, Fall 2009, PI: M. I. Hayee. Funded amount: \$750.
13. Special Research Travel Grant by the office of International Center, University of Minnesota for travel to Turkey to present a research paper in IEEE's Photonics Society's Annual Meeting, 2009. Fall 2009, PI: M. I. Hayee, Funded amount: \$1,366.
14. Special Research Funding by Vice Chancellor's Office, "Mining the Optical Fiber Bandwidth via Electrical Signal Processing", October 2008 - December 2009. PI: M. I. Hayee, Funded amount: \$14,900.
15. NASTRL 08 -09, "Development of a Low-Cost Interface between Cell Phones and DSRC-based Vehicle Unit for Efficient Use of VII Infrastructure", July 1, 2008 - June 30, 2009, PI: M. I. Hayee, Funded amount: \$62,346.
16. Chancellor's small grants, Fall 2008, PI: M. I. Hayee. Funded amount: \$750.

17. Whiteside Institute Grant, "Heart Murmur Detection Using Cochlea like Signal Processing", Jan 1, 2008 to Dec. 31, 2008, PI: M. I. Hayee, Funded amount: \$15,000.
18. Chancellor's small grants, Fall 2007, PI: M. I. Hayee. Funded amount: \$750.
19. Grant-In-Aid from the Office of Vice Chancellor, University of Minnesota, "40 Gb/s Transmission on Conventional Fiber Dispersion Maps" Jan2005 to July 2006, PI: M. I. Hayee. Funded amount: \$24,500.

HONORS:

1. Outstanding Innovator Award, Dec. 2014, University of Minnesota
2. Chancellor's Distinguished Research Award, 2011-2012, University of Minnesota Duluth
3. Best Teacher Award, 2007, Swenson College of Science and Engineering
4. Elected as Senior Member of IEEE in Nov. 2005
5. Science and Technology Scholarship Award for graduate studies, 1994 - 1998 (\$60,000)
6. B.Sc. Engineering with Honors, 1992, University of Engineering and Technology, Lahore, Pakistan