CURRICULUM VITAE

ANDRÉS ALAYÓN GLAZUNOV

October, 2013

1. PERSONAL DATA

1.1 Name.

Andrés Alayón Glazunov

1.2 Date of birth.

1 of June 1969

1.3 Gender.

Male

1.4 Home address and telephone number.

Home address: Västervägen 14, 1968 Upplands Väsby, Stockholm, Sweden
Home telephone number: +46 (0)8 590 89603
Cellular phone number: +46(0)70 7490601

1.5 Contact address, telephone, e-mail address.

Work address: Royal Institute of Technology, School of Electrical Engineering, Electromagnetic Engineering Lab, (KTH Skolan för Elektro- och Systemteknik), Teknikringen 33, Stockholm, Sweden.
Work telephone number: +46 (0)8 790 8369.
Work e-mail address: aag@ee.kth.se.

1.6 Present position.

Researcher, 1/10/2012-Present
KTH Royal Institute of Technology, Electromagnetic Engineering Department, Stockholm, Sweden

1.7 Previous employments.

Postdoc, 2010-2012
KTH Royal Institute of Technology, Electromagnetic Engineering Department, Stockholm Sweden

Marie Curie Senior Research Fellow, 2009 – 2010
University of Bedfordshire, Centre for Wireless Network Design, Luton, U.K.

Research Fellow, 2006 – 2009
Lund University, Electrical and Information Technology, Lund, Sweden

Senior Specialist, Antenna Systems and Propagation, 2003 - 2006
TeliaSonera Sweden AB, Mobile Networks R&D, Farsta, Sweden (Paternal leave for child care, 5 months in 2004)

Senior Research Engineer, 2001 - 2003
Telia Research AB, Mobile Wireless Communications Department, Farsta, Sweden

Research Engineer, 1997 - 2001
Ericsson Research, Access Technologies and Signal Processing Department, Kista, Sweden (Paternal leave for child care, 5 months in 2001).

Project Research Engineer, 1996 - 1997
Ericsson Research, Access Technologies and Signal Processing Department, Kista, Sweden.

1.8 Other information.

I completed my PhD in 2.5 years which is about half of the nominal time. This was possible thanks to the opportunity to complete part of the course work at my spare time during a year and half when I was at TeliaSonera. However, all the research presented in my doctoral thesis was produced within the two and a half years as a Research Fellow in Lund University.

2. DEGREES, ASSESSMENTS AND EVALUATIONS

2.1 Academic degrees including year of graduation.

PhD in Electrical Engineering, Radio Systems, Lund University, Lund, Sweden, 2009 (see enclosed Appendix A for transcript and diploma)

MS in Electrical Engineering (Engineering Researcher), Physical Electronics, 1994. Saint Petersburg State Polytechnic University, St. Petersburg, Russia. (Thesis: 5.00/5.00, Weighted GPA: 4.75/5.00, see enclosed Appendix B for transcript and diploma)

2.2 Conferment of the title of docent including year awarded.

I will apply for the docent qualification in fall 2013. I have passed the required course LH207V, Research Supervision, 3 ECTS at the KTH Learning Lab in 2013.

2.3 Evaluations of own scientific effort.

Review form regarding the project application: Modeling of antenna-channel interactions for optimal wireless communication over multipath channels by the Swedish Research Council (VR). (See enclosed Appendix C)

2.4 Previous expert assessments may be enclosed. (NA)

2.5 Other information.

My philosophy in a nutshell: When thinking about research, I follow the model that categorises research into three main groups. The first group refers to basic research, where we seek to find answers to questions of a fundamental nature, e.g., the origin of the Universe. The second group is the traditional applied research, where we are more interested in making something work or in solving a practical problem but less interested in connecting research to a larger theoretical framework. The third one is the "use-inspired basic research", which is devoted to solving problems and to finding solutions that improve the lives of the people around us and is the most relevant to my research interests. Use-inspired basic research combines the quest for fundamental understanding and improved technology. To succeed in this mission requires research across many disciplines which in my particular case rely on classical

electromagnetic field theory, antenna theory and practice, stochastic signal processing, wireless communication techniques and information theory.

3. SCIENTIFIC ACHIEVEMENTS

3.1 Brief account of own research profile.

My PhD thesis [13] consists of the content in the journal articles [5, 6, 7, 8], and the conference contribution [27]. The thesis work was supervised by Professor Andreas F. Molisch, currently at the University of Southern California (USC), USA. During my PhD studies I also produced the conference contributions [28, 29, 30, 31] not included in the thesis. While working as a Research Engineer at Ericsson Research, I produced the journal article [8], the conference contributions [40, 41, 42, 43, 44, 45, 46, 49] and the ITU technical contributions [59, 60]. While at Telia Research I produced, as a Senior Research Engineer, the conference contributions [38, 48] and the 3GPP technical contributions [50,51]. As a Senior Specialist in Antenna Systems and Propagation I produced the book chapter [17] and the conference contributions [32, 33, 34, 35, 36, 37, 38, 39, 48]; I also produced the 3GPP technical contributions [52, 53, 54, 55, 56, 57, 58]. As a postdoc in Bedfordshire, U.K., I produced the journal article [3], the conference contributions [22, 23, 24, 25, 26] and the openly available manuscript [62]. First as a Postdoc and a later as a Researcher at KTH, I have so far produced the journal articles [1, 2, 3, 10, 11, 12], the book [14], the book chapters [15, 16], the conference contributions [18, 19, 20, 46] and the openly available manuscript [60]. In addition to the above, I produced during my years working as a scientist in industry research labs several tens of technical reports involving antenna measurements, channel measurements, electromagnetic code analysis, signal processing algorithm development and theoretical derivations.

My ability to work independently is reflected in a number of publications produced as the sole author [2, 3, 21, 26, 36, 38, 39, 40, 46, 48, 49, 61]. Another example is the fact that in my doctoral dissertation I carried out the most of the analysis and all the derivations and computations. As the sole author I received the Best Paper Award at the International Workshop on Propagation and Channel Modeling for Next-Generation Wireless Networks (IWPCM) 2011, Lyon, France. I was featured, also as the sole author, in Electronics Letters issue 24, November 27nd, 2012. In addition to working independently, I have had the opportunity to work with a great amount of outstanding people including my theses supervisors, research collaborators, my colleagues in industry and my master and doctoral students. A good example of team work where I together with many co-authors of different national backgrounds have contributed to a common publication is the book [15]. As many as 35 researchers from 13 countries (Europe, Asia and America) contributed to the book. Another example is that in average I have 2 additional co-authors to my papers. Working as a supervisor of PhD-students has resulted in publications [11, 12, 19, 20, 23, 31], while working with MS students resulted in [32, 33, 43]. Collaboration with one PhD-student resulted in a Best Paper Award at the 29th Antenna Measurement Techniques Association Symposium (AMTA) 2007 [31]. In order to keep excellence in my research output I always aim at publishing in the most prestigious journals (and conferences) in the field, for example, the IEEE Transactions on Antennas and Propagation [5, 7, 10, 11, 12].

My research interest is focused on developing practical and theoretical frameworks for modelling antenna-channel interactions necessary to produce high-performance wireless systems in terms of spectral efficiency and energy efficiency. I put great emphasis on the characterisation of the transmission properties of wireless communication systems by means of studying the fundamental characteristics of propagation channels, their deterministic and stochastic behaviours as well as the underlying mechanisms. In my research I try to combine advanced signal processing and electromagnetic techniques

exploiting the spatial, the directional and the polarisation domains of the transmitted signals. I have put a particular emphasis on MIMO antenna systems and channels, MIMO system performance evaluation, scattering theory, radio propagation modelling, radio propagation measurements, OTA (Over-The-Air) antenna measurements and wireless network optimization. Since the start of my academic research I have developed a formalism based on mathematical physics offering an exploration framework for antenna-channel interactions. It integrates a deterministic modelling of antennas with a characterization of the stochastic propagation channels on the basis of fundamental physical laws.

In the following I present a synopsis of some the results I have obtained since the start of my academic research in 2006. An abridgement referring to my results obtained while working as an industrial research scientist is given in Section 3.6.

I have discovered physical limitations on the antenna gain patterns in wireless propagation channels [4]. This is the first attempt ever to interrelate the properties of an antenna to the properties of a radio propagation channel. The physical limitations considers the interactions of antennas exciting TM or TE spherical vector wave modes (but not both) and wireless propagation channels. The result is an extension of the crucial work of Chu on the classical limitations on maximum antenna gain and radiation. The obtained physical limitations on the antenna gain pattern are directly translated to more condensed parameters, i.e., the instantaneous link gain and the mean effective gain if instantaneous realizations or correlation statistics of the expansion coefficients of the electromagnetic field are available. The obtained limitations establish a trade-off between link gain and antenna Q-factor. I have also derived the maximum joint transmit and receive maximum ratio combining (MRC) diversity gain in arbitrary MIMO (Multiple Input Multiple Output) wireless propagation channels and the corresponding transmit and receive antenna coefficients [1]. In the analysis, spherical vector wave multipole modes of order l are considered, including both TE and TM modes. The obtained result provides an all-inclusive approach to antennas, signal processing and wireless systems.

I have devised a physically motivated channel model that allows the study of the interaction between the antennas and the propagation channel for multiple-input multiple-output (MIMO) systems [6, 7, 3]. I derived the expansion of the MIMO channel matrix H in spherical vector wave modes of the electromagnetic field of the antennas as well as the propagation channel. I achieved this by introducing the concept of M-matrix or M-operator producing a mode-to-mode mapping between receive and transmit antenna modes. By this ansatz I was able to connect the covariance statistics of the propagation channel to the modes of the antennas. As a result the M-matrix properties are expressed as a function of the double-directional power-angular spectrum (PAS) of co-polarised and cross-polarised components of the electromagnetic field. This approach allows gaining new insights into the physics governing the interaction between antennas and channels. It usefulness is also revealed when studying the performance of different antenna designs in a specified propagation channel, but also when modelling the propagation channel itself by reducing the number of estimated parameters. It can furthermore be used to quantify the optimal properties of antennas in a given propagation channel as we have done in [2, 4, 21, 24]. I have also produced closed form expressions for the covariance of the field multimodes as a function of the power angle spectrum (PAS) and the channel cross-polarization ratio (XPR). In addition, I provided an alternative interpretation of the mean effective gain (MEG) of an antenna. I showed that the maximum MEG is obtained by conjugate mode matching between the antennas and the channel. I also proved the (intuitive) results that decorrelated antenna signals are obtained by the excitation of orthogonal spherical vector modes. I further developed this ideas in [2, 4, 25] where I derived antenna coefficients satisfying various criteria, e.g., maximum MIMO mean effective link gain (link MEG) based on the multimode

channel realizations, or maximum MIMO link MEG based on the multimode correlation matrix or correlation minimization by diagonalization of the MIMO full-correlation matrix.

I provide an analysis framework of fundamental properties of the MEG of an antenna in [8] with corresponding physical interpretations that allows for a better analysis of antenna performance in multipath channels. Firstly, I showed that MEG can be written as a sum of gains for the deterministic and stochastic components in a mixed environment with both stochastic and deterministic components. Secondly, I showed that under some assumptions, the propagation channel and the antenna are equivalent in the sense that the impact of the channel cross-polarisation ratio (XPR) and the antenna effective cross-polar discrimination on the MEG are symmetrical. Thirdly, based on the fact that MEG depends on random variables, such as the XPR and antenna rotations because of user's movements, I showed that the average, the minimum and maximum MEG of antennas can be defined accordingly. Finally, I derived an upper bound for the maximum effective gain of antennas in a wireless channel which is given by radiation efficiency of the antenna multiplied by the solid angle of the sphere.

The design of antennas with optimized performance in multipath channels is addressed in [10]. There, I with co-workers introduced a mutual scattering mode that reduces the correlation between MIMO antenna elements (even down to zero) by increasing the Q factors of the MIMO antenna elements. The Q factors were straightforwardly tuned through different input impedance matching. We also showed that the zero correlation occurred at a Q factor higher than that resulting from the conjugate input impedance matching. We further showed that if the inter-element distance is larger than a certain Critical Distance, the total efficiency can also be improved in addition to reducing the correlation. Furthermore, when the inter-element distance is less than the Critical Distance, a reference MIMO antenna with high correlation and high total efficiency is obtained. This antenna can be used as a reference for OTA measurement applications. A wideband MIMO antenna, with multiple resonances, covering the band 746-870 MHz is proposed with the envelope correlation coefficient and total efficiency less than 0.5 and higher than -3dB, respectively, which is a promising result.

Large-scale multiple antenna wireless systems with hundreds of low-power antennas, that may be co-located at a base station site, spread out on the face of a building, or distributed geographically may provide advantages over conventional MIMO and cooperative networks. In this context, I have characterized the radio propagation channel properties of a reverberation chamber for OTA testing of very large MIMO systems and presented them in [12]. The analysis is based on very large virtual uniform linear array measurements with focus on the multidimensional characterization of the channel transfer function and the channel impulse response as a function of position and time. The presented analysis shows that beside the rich isotropic radio propagation channel naturally encountered in reverberation chambers, more realistic very large MIMO channels can also be emulated suggesting the possibility of a laboratory evaluation of large antenna systems.

Also related to OTA I, with co-workers have investigate the unwanted scattering that exists within the MultiPath Simulator (MPS) array antennas employed in Over The Air (OTA) testing of mobile terminals [10]. The impact of scattering is evaluated in terms of the measurement uncertainty of the average received power and the Ricean K−factor. We provide closed-form expressions for the uncertainties of the average received power and the Ricean K−factor for a uniform circular array of MPS antennas and 2D uniformly distributed angle-of-arrival spectrum. Based on the Fraunhofer distance, we also derive the maximum number of MPS antennas and the minimum ring radius of the MPS system as a function of the separation between the most distant antenna elements if the device under test employs a uniform linear

array. As a result, we provide design guidelines for MPS array in terms of the number of antennas, the radius of the MPS array, the physical size of the device under test and the carrier frequency.

3.2 Research interest.

My research approach is characterized by a multidisciplinary approach lying at the intersection among various fields of knowledge, such as, classical electromagnetic field theory, antenna techniques, radio communication theory and stochastic signal processing techniques. An integral part of the research includes theoretical developments as well as the analysing of experimental data and measurements. Essential to produce the research outcomes is the application of advanced mathematical physics tools, inverse problems, stochastic signal processing and statistical data mining techniques in addition to numerical modelling and simulations..

3.3 List of publications.

Books: 1
Book chapters: 3
Theses: 2
Journal papers: 12=9(published) + 3(under review)
Conference papers: 32
arXiv manuscripts: 2
COST Actions Technical Documents: 14
Expert Standardization Contributions: 11
H-index: 9, G-index: 15 (From Google Scholar & Harzing's PoP)
Number of citations: 297 (From Google Scholar & Harzing's PoP)

3.3.1 Papers published in internationally reputed periodicals which have been subject to referees´ assessment. (Number of citations in parenthesis)

Papers published in internationally reputed periodicals

[1] S. Zhang, A. Alayon Glazunov, Z. Ying and S. He. Reduction of the Envelope Correlation Coefficient with Improved Efficiency for Mobile LTE MIMO Antenna Arrays Part I: Mutual Scattering Mode, Antennas and Propagation, IEEE Transactions on, vol.61, no.6, pp.3280,3291, June 2013

[2] A. Alayon Glazunov. Maximum joint transmit-receive MRC gain with antennas exciting spherical vector wave modes up to order l, IET Electronics Letters, Volume 48, issue 24, November 2012, p. 1520 - 1522.

[3] A. Alayon Glazunov. Expansion of the Kronecker and Keyhole Channels into Spherical Vector Wave Modes, Antennas and Wireless Propagation Letters, IEEE , vol.10, no., pp.1112-1115, 2011.(1)

[4] A. Alayon Glazunov and J. Zhang. On Some Optimal MIMO Antenna Coefficients in Multipath Channels, Progress In Electromagnetics Research B, Vol. 35, 87-109, 2011.(1)

[5] A. Alayon Glazunov, M. Gustafsson, and A. F. Molisch. On the physical limitations of the interaction of a spherical aperture and a random field, Antennas and Propagation, IEEE Transactions on, Vol.59, No.1, pp.119 - 128, Jan. 2011.(6)

[6] A. Alayon Glazunov, M. Gustafsson, A. F. Molisch, and F. Tufvesson. Physical modeling of MIMO antennas and channels by means of the spherical vector wave expansion, IET Microwaves, Antennas and Propagation, Vol.4, No.6, pp.778 - 791, June 2010.(15)

[7] A. Alayon Glazunov, M. Gustafsson, A. F. Molisch, F. Tufvesson, and G. Kristensson. Spherical vector wave expansion of Gaussian electromagnetic fields for antenna-channel interaction analysis. Antennas and Propagation, IEEE Transactions on, Vol.57, No.7, pp.2055 - 2067, July 2009. (24)

[8] A. Alayon Glazunov, A. F. Molisch, and F. Tufvesson. Mean effective gain of antennas in a wireless channel, IET Microwaves, Antennas and Propagation, Vol. 3, No. 2, pp. 214 - 227, March 2009. (7+4)

[9] H. Asplund, A. Alayon Glazunov, A. F. Molisch, K. I. Pedersen, and M. Stenbauer. The COST 259 Directional Channel Model Part II: Macrocells, Wireless Communications, IEEE Transactions on, Vol. 5, No. 12, pp. 3434 - 3450, December 2006. (88)

Papers in revision

[10] A. Alayon Glazunov, P. Sathyaveer, P. Händel, Thomas Bolin and K.Prytz. Impact of the Scattering within a MPS Antenna Array on the Measurement accuracy of OTA Tests of Mobile Terminals, Antennas and Propagation, IEEE Transactions on. (3rd round of review, September 2013)

[11] A. Alayon Glazunov, P. Sathyaveer, and P. Händel, Experimental Characterization of Propagation Channel in Reverberation Chamber for Very Large MIMO OTA Testing, Antennas and Propagation, IEEE Transactions on (1st round of review, December 2012).

[12] A. Alayon Glazunov, On a Fundamental Limitation of a Diversity Measure of MIMO Radio Propagation Channels, Antennas and Wireless Propagation Letters, IEEE (1st round of review, September 2013)

3.3.2 Other publications, including books.

Theses

[13] A. Alayon Glazunov. On the antenna-channel interactions: A spherical vector wave expansion approach. Doctoral Dissertation at the Department of Electrical and Information Technology, ISSN: 1654-790X, Lund University, Lund, March 2009.(14)

[14] A. Alayon Glazunov. Kinetics of the radial distributions of the excited states of the helium atom in the positive pole of capillary discharge. (In Russian) Master of Science Thesis at Department of Physical Electronics, Saint Petersburg State Technical University, February 1994.

Text books and book chapters

[15] G. de La Roche, A. Alayon Glazunov and B. Allen (Eds.). LTE-Advanced and Next Generation Wireless Networks - Channel Modelling and Propagation, John Wiley & Sons, October 2012.

[16] A. Alayon Glazunov, Z. Lai and J. Zhang. Chapter 5 Outdoor-Indoor Channel in LTE Advanced and Next Generation Wireless Networks - Channel Modelling and Propagation, John Wiley & Sons, October 2012.

[17] A. Alayon Glazunov, V. M. Kolmonen and T. A. Laitinen. Chapter 15 MIMO Over-the-Air Testing in LTE-Advanced and Next Generation Wireless Networks - Channel Modelling and Propagation, John Wiley & Sons, October 2012.

[18] P. Degauque, A. Alayon Glazunov, A. Sibille, and J. Pamp. Antennas and diversity: from narrowband to ultra-wide band. Book chapter in Mobile Broadband Multimedia Networks: techniques, models and tools for 4G, pp. 218 - 276, ISBN 0 - 12 - 369422 - 1, Academic Press, Elsevier, 2006.(No. of citations(Book): 174)

International peer-reviewed conferences

[19] C. Fang, B. Allen, E. Liu, J. Zhang, A. Alayon Glazunov, F. Tufvesson. Indoor-Indoor and Indoor-Outdoor Propagation Trial Results at 2.6 GHz. LAPC 2012 - Loughborough Antennas and Propagation Conference 2012, Loughborough University, UK.

[20] C. Fang, B. Allen, P. Karadimas, E. Liu, J. Zhang, A. Alayon Glazunov, F. Tufvesson. Empirical Indoor-to-Outdoor and Building-to-Building Propagation Model at 2.6 GHz. COST IC1004+ iPLAN Joint Workshop on Small Cell Cooperative Communications, 2nd May, 2012, Lyon.

[21] A. Alayon Glazunov. A Monte Carlo Study on the Diversity Measure of a Spherical Volume, in Proc. of the 6th European Conference on Antennas and Propagation (EuCAP), March 2012, Prague, Czech Republic.

[22] X. Zhang, D. Zhou, Zh. Xiao, E. Liu, J. Zhang, Andres Alayon Glasunov. Dynamic Group PCI Assignment Scheme, The Seventh International Conference on Wireless and Mobile Communications (ICWMC 2011), Luxembourg City, Luxembourg, 19 - 24 June, 2011

[23] X. Gao, A. Alayon Glazunov, J. Weng, C. Fang, J. Zhang, and F. Tufvesson. Channel measurement and characterization of interference between residential femto-cell systems, 5th European Conference on Antennas and Propagation (EuCAP 2011), Rome, Italy, 11 - 15 April 2011.(1)

[24] A. Alayon Glazunov and J. Zhang. Clustering impact on the statistics of the multipole expansion coefficients of a wireless channel, Progress in Electromagnetic Research Symposium, (PIERS 2011), Marrakesh, Morocco, 20 - 23 March 2011.

[25] A. Alayon Glazunov and J. Zhang. Some Examples of Uncorrelated Antenna Radiation Patterns for MIMO Applications, Progress in Electromagnetic Research Symposium, (PIERS 2011), Marrakech, Morocco, 20 - 23 March 2011.(1)

[26] A. Alayon Glazunov. Kronecker and Keyhole Channels Expansion into Spherical Vector Wave Multipole Modes, International Workshop on Propagation and Channel Modeling for Next-Generation Wireless Networks, (IWPCM2011), 2 - 4 March 2011, Lyon, France.

[27] A. Alayon Glazunov, F. Tufvesson, M. Gustafsson, A.F. Molisch, and G. Kristensson. Branch cross-correlation in presence of spatially selective interference expressed in terms of the spherical vector wave expansion of the electromagnetic field. Proceedings of the URSI General Assembly (URSIGA2008), Chicago, IL, U.S., 7 - 16 Aug. 2008. (1)

[28] A. Alayon Glazunov, M. Gustafsson, A.F. Molisch, F. Tufvesson, and G. Kristensson. On the mean effective gain expressed in terms of the spherical vector wave expansion of the electromagnetic field. Proceedings of the URSI General Assembly (URSIGA2008), Chicago, IL, U.S., 7 - 16 Aug. 2008.

[29] A. Alayon Glazunov, A.F. Molisch, and F. Tufvesson. Fading characterization in a semi anechoic chamber with artificial scatterers for mean effective gain measurements of wireless handheld terminals, Proceedings of the IEEE Radio and Wireless Symposium (RWS 2008), Orlando, FL, U.S., 22 - 24 Jan. 2008.

[30] A. Alayon Glazunov, F. Tufvesson, and A.F. Molisch. A note on the mean effective radiated power and the mean effective receiver sensitivity of mobile handheld terminals. Proceedings of the IEEE International Symposium on Antennas and Propagation Society (AP-S 2008), San Diego, CA, U.S., 5 - 11 July 2008.(1)

[31] S. Prasad, P. Ramachandran, A. Alayon Glazunov, and C. Beckman. Evaluation of the Telia scattered field measurement method for estimation of in-network performance of mobile terminal antennas. Proceedings of the 29th Antenna Measurement Techniques Association Annual Meeting and Symposium (AMTA 2007), St Louis, MO, U.S., 9 - 11 Nov. 2007. (4)

[32] A. Alayon Glazunov, Y. Wang, and P. Zetterberg. Experimental evaluation of CW MIMO channel capacity in urban multicell environment. Proceedings of the 9th International Symposium on Wireless Personal Multimedia Communications (WPMC'06), San Diego, CA, U.S., 17- 20 Sep. 2006.

[33] A. Alayon Glazunov, Y. Wang, and P. Zetterberg. Decorrelation distance characterization of long term fading of CW MIMO channels in urban multicell environment, 18th International Conference on Applied Electromagnetics and Communications (ICECOM 2005), 12 - 14 Oct. 2005, Dubrovnik, Croatia.(1)

[34] A. Dahlen and A. Alayon-Glasunov. Admission Control at UMTS spectrum sharing, IEEE International Conference on Software, Telecommunications and Computer Networks (SoftCOM 2005), Split, Marina Frapa, Croatia, 15 - 17 Sep. 2005.

[35] A. Alayon Glazunov, R. Ljung, and P. Karlsson. Cost analysis of smart antenna system deployment, 61st IEEE Vehicular Technology Conference (VTC 2005-Spring), Stockholm, Sweden, 30 May - 1 June 2005. (3)

[36] A. Alayon Glazunov. Joint impact of the mean effective gain and base station smart antennas on WCDMA-FDD systems performance, Nordic Radio Symposium (NRS 2004), Oulu, Finland, 16 - 18 Aug. 2004.(5)

[37] A. Alayon Glazunov. Mean effective gain of user equipment antennas in double directional channels, 15th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'04), Barcelona, Spain, 5-8 Sep. 2004.(5)

[38] A. Alayon Glazunov and Ermin Pasalic. Comparison of MEG and TRPG of practical antennas, 15th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'04), Barcelona, Spain, 5-8 Sep. 2004.(4)

[39] A. Alayon Glazunov. Theoretical analysis of mean effective gain of mobile terminal antennas in Ricean channels, 56th IEEE Vehicular Technology Conference (VTC 2002-Fall), Vancouver, Canada, Sep. 24 - 28, 2002.(16)

[40] A. Alayon Glazunov. On the distribution of relevant radio channel figures in different propagation environments for performance evaluation of WCDMA systems, Proceedings of IEEE VTC'01spring, Rhodes, Greece. (2)

[41] J. Medbo, J-E Berg, A. Alayon Glazunov. Combined direction-delay channel characteristics at 5 GHz in typical office environment, Proceedings of Nordic Radio Symposium'01, Stockholm, Sweden. (1)

[42] A. Alayon Glazunov and J-E Berg. Building shielding loss modeling, 51th IEEE Vehicular Technology Conference (VTC 2000-Spring), Tokyo, Japan, May 15 - 18, 2000. (10)

[43] A. Alayon Glazunov, L. Hamberg, and J. Medbo. Building shielding loss measurements and modeling at the 5GHz band in office building areas, 52nd IEEE Vehicular Technology Conference (VTC 2000-Fall), Boston, MA, USA, Sep. 24 - 28, 2000.(13)

[44] A. Alayon Glazunov, H. Asplund, and J-E Berg. Statistical analysis of measured short term impulse response functions of 1.88 GHz radio channels in Stockholm with corresponding channel model, 50th IEEE Vehicular Technology Conference (VTC 1999 - Fall), Amsterdam, the Netherlands, Sep. 19 - 22, 1999.(12)

[45] H. Asplund, A. Alayon Glazunov, J-E Berg. An investigation of measured and simulated wideband channels with applications to 1.25 MHz and 5 MHz CDMA systems, Proceedings of IEEE VTC'98, Ottawa, Canada.(9)

[46] A. Alayon Glazunov. Considerations regarding the number of RAKE fingers required in CDMA RAKE receivers, Proceedings of Nordic Radio Symposium'98, Saltsjöbaden, Sweden.(3)

National conferences

[47] A. Alayon Glazunov and B. L. G. Jonsson. A Monte Carlo Simulation Investigation of the Directivity to Mean Effective Gain Ratio of Antennas in Wireless Multipath Channels, Antenn/Conf. on Computational Electromagnetics, EMB2012, Stockholm, Sweden, 2012

[48] A. Alayon Glazunov. On the user equipment antenna performance, In Proceedings of Joint COST273&COST284 Workshop, Gothenburg, Sweden, 7- 9 June 2004. (1)

[49] A. Alayon Glazunov. Performance analysis of impulse radio based on ultra wideband channel model for indoor communications, Proceedings of Radio Science and Communication Conference'02, Stockholm, Sweden.

3.3.3 Publications for a first-hand background reference.

Please refer to publications [1, 2, 3, 4, 5, 6, 7, 8, 9]. See enclosed Appendix E.

I have chosen these publications because they show the main contributions I have made to the analysis of antenna-channel interactions in multipath channels by combining electromagnetic field theory and signal processing.

Please refer also to Sections 3.1 and 3.2 in order to put these publications in the proper context. The chosen publications reflect a great deal of the importance of cooperation and collaboration in scientific research to reach the posed goals in a multidisciplinary and international research environment.

3.4 Grants which have been appropriated.

3.4.1 Research council funds.

254 000 SEK from Vinnova AM3-II project: Access technologies: multiple access, multiple users, multiple distributed antenna systems, Part II (2012). PI: Björn Ottersten. I drafted 33% of the proposal as a team member of the project.

3.4.2 Funding from EU, trusts or other sources. (NA)

3.4.3 Funding from trade and industry and public authorities. (NA)

3.4.4 Other funding.

500 000 SEK, as PI for the project “Over the air testing of small and large antenna systems”, KTH funding provided by the Signal Processing Lab.

3.5 Other scientific achievements.

3.5.1 Active participation in national and international conferences.

- Session organizer and chair: Antenna Channel Interactions and Multipath Wireless Channels, The 34th Progress in Electromagnetic Research Symposium (PIERS 2013), Stockholm, Sweden
- Session organizer and chair: Antenna Channel Interaction in Multipath Wireless Channels, The 29th Progress in Electromagnetic Research Symposium (PIERS 2011), Marrakesh, Morocco
- Session Chair: Antennas for Mobile Communication Systems-II, 2008 IEEE Antennas and Propagation Symposium (APS), San Diego, California USA
- Co-Chairman of the SWG 2.2 on Handset Antennas at the COST 273 "Towards Mobile Broadband Multimedia Communications", May 2001 - June 2005, which contributed to standardisation efforts in 3GPP and to the deployment of UMTS networks, provided channel models for MIMO systems and initial inputs to the research on B3G generation systems.

I have been invited to give the following talks:

- "On the Optimal Transmit and Receive Antenna Coefficients in Multipath Channels," University of Bedfordshire Conference 2010: Bridging the Gaps, Luton Campus, Park Square, 6th-7th July 2010
- "On the Modeling of Antenna-Channel Interactions for High-Performance Wireless Systems," Technical seminar at the Communication Systems Division, Electrical Engineering Dpt., Linköping, Sweden, September 10th, 2009
- "On the antenna-channel interactions: A spherical vector wave expansion approach," Technical seminar at the Signal Processing Dpt., School of Electrical Engineering, Stockholm, Sweden, April 2009
- "Antenna Performance Assessment of Mobile Handsets," COST Action 273- Towards Mobile Broadband multimedia networks, In proceedings of Final Workshop, Katholieke Universiteit Leuven, Leuven, Belgium, June 6-7 2005
- "MIMO and mobile relays," Affordable Wireless Services & Infrastructure, 3rd Program Workshop, Såstaholm, Stockholm, Sweden, June 2-3, 2005
- "Handset antenna performance measurement results," Tekniksemiarium på LTH om Antenn & Kanalforskning, Lund University, 5th April 2005
- "Mobile Terminal Antenna Performance," "Radio Engineering Day," University of Gävle ("Högskolan i Gävle"), Gävle, Sweden, 2nd March 2004
- "Mobile Terminal Antenna Performance Measurements-Estimating MEG from TRP," 4th Terminal Antenna Measurement Day, Chalmers University of Technology, Gothenburg, Sweden, 18th March 2004

3.5.2 National and international awards.

- Featured author, in Electronics Letters issue 24, November 27nd, 2012.
- Best Paper Award at the International Workshop on Propagation and Channel Modeling for Next-Generation Wireless Networks (IWPCM) 2011, Lyon, France, March 2 - 4.
- Marie Curie Experienced Researcher Fellowship (2009 - 2010)
- Best Paper Award together with Ramachandran Prasadh, Prasad Sathyaveer and Claes Beckman on Session 16 at the 29th Antenna Measurement Techniques Association Symposium (AMTA) 2007, St Louis, U.S., Nov. 9 -11.
- Mentioned research contributor, in Research Excellence of the Signal Processing Lab, KTH Royal Institute of Technology.

3.5.3 Membership of academies and the like.

Institute of Electrical and Electronics Engineers (IEEE), Senior Member.

3.5.4 Editorial or advisory assignments in international periodicals. (NA)

3.5.5 Review / referee assignments by the above.

IEEE Transactions on Antennas and Propagation (<6/year)
IEEE Transactions on Wireless Communications (<3/year)
IEEE Journal on Selected Areas in Communications (<2/year)

IEEE Transactions on Broadcasting (<2/year)
IEEE Communications Letters (<3/year)
IET Electronic Letters (<3/year)
EURASIP Journal on Wireless Communications and Networking, Elsevier (<2/year)
Progress in Electromagnetic Research (PIER) (<6/year)
Transactions on Emerging Telecommunications Technologies, Wiley (<3/year)

3.5.6 Assignments as public examiner/opponent. (NA)

3.5.7 Assignments as outside expert.

Evaluation of research and scholarly work of one candidate for the award of the Conference of Professors and Heads of Computing (CPHC), in conjunction with BCS and the BCS Academy of Computing Distinguish Dissertations Committee 2013, UK.

3.5.8 Own patents. (NA)

3.5.9 Exhibitions. (NA)

3.5.10 Build up of, participation and cooperation in international networks.

I have participated as a member and contributor to several national and international research consortia:

- COST Action IC1004, "Cooperative Radio Communications for Green Smart Environments" (2011 - present)
- Marie Curie EU FP7 IAPP "IAPP@RANPLAN" on Automatic Radio Access Network Planning and Optimisation project under grant PEOPLE-2007-3-1-IAPP-218309, Bedfordshire, U.K. (2010)
- Marie Curie EU FP6 "GAWIND" on Grid-Enabled Automatic Wireless Network Design project under grant MKTD-CT-2006-042783, Bedfordshire, U.K. (2009 - 2010)
- HSWC, SSF center for High Speed Wireless Communications, Lund, Sweden (2006 - 2009)
- NEWCOM IST, Network of excellence in wireless communication (2005 - 2007)
- EVEREST IST, Evolutionary Strategies for Radio Resource Management in Cellular Heterogeneous Networks (2004 - 2006)
- Affordable Wireless Services & Infrastructure (AWSI) Project, Spatio - Temporal Design, Wireless@KTH, Stockholm, Sweden (2003 - 2005)
- Swedish delegate and Telia Research AB/TeliaSonera Sweden AB representative at COST Action 273, "Towards Broadband Multimedia Networks" (2001 - 2005)
- Ericsson AB representative at COST Action 259, "Wireless Flexible Personalized Communications" (1997 - 2001)

3.6 Scientific qualifications of a non-academic nature.

I have 10 years' of experience of industrial research at leading telecommunication companies in Sweden including Ericsson Research, Telia Research and TeliaSonera. I have contributed to international telecommunication standardization activities within the 3rd Generation Partnership Project (3GPP) and the International Telecommunications Union (ITU).

- **TeliaSonera (2003-2006), book chapter [18], conference articles [32, 33, 34, 35, 36, 37, 38, 39, 48], 3GPP standards contributions [52, 53, 54, 55, 56, 57, 58].**
- **Telia Research (2001-2003), conference articles [39, 49], 3GPP standards contributions [50, 51].**
- **Ericsson (1996-2001), journal article [8], conference articles [40, 41, 42, 43, 44, 45, 46, 49], ITU standards contributions [59,60].**

My achievements obtained at TeliaSonera are listed here below:

- Derived models for the mean effective gain of an antenna that accounted for the double directional property of the RF propagation channel. The model includes the effects of both the channel polarization and the receiver and transmitter polarizations.
- Defined new parameters in order to characterize uplink and downlink antenna performance including actual performance in a real life propagation channel and derived performance bounds for the mean effective gain of handset antennas.
- Devised a simple approach to characterize the mean effective gain of handset antennas and investigated the impact of antenna orientation and position relative the user's head on the mean effective gain of the antenna.
- Introduced the concept of partial mean gain and average cross-polar discrimination of the antenna.
- Proposed radiated performance limits in terms of TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) for GSM and UMTS handsets.
- Showed by means of system simulations how detrimental is poor handset antenna performance to both coverage and capacity in UMTS.
- Defined and conducted research on smart and MIMO antenna systems and channels. Proposed and led a measurement campaigns on CW (Continuous Wave) MIMO in urban environments.
- Proposed a model for signal de-correlation of shadow fading, and derived a model for spatial correlation and excess path loss.
- Analysed the impact of terminal antenna orientation relative to a street canyon together with the base station antenna height on MIMO system capacity.
- Evaluated financial aspects of the deployment of smart antenna systems in UMTS networks; performed UMTS network optimization research.
- Developed a model for system level simulations calculating the interference factor in UMTS networks used in RRM algorithms development for shared networks in urban hot spot environments.
- Devised a method for including the effects transmitted wave depolarization in order to fulfil PTS (Post och TeleStyrelsen) CPICH coverage requirements.
- Developed and implemented a system simulation model to investigate the impact of transmit-diversity at BS on UMTS capacity and coverage.

Achievements at Telia Research are given next.

- Derived a model for MEG of an antenna in Ricean fading channels.
- Studied handset radiated performance measured by means of the "Telia Scattered Field Measurement" and the reverberation chamber.
- Investigated the effects of fictitious scatterers introduced in anechoic chambers on the accuracy of handset antenna measurements.

- Evaluated the impact of the phantom head model on handset radiated performance measurements.
- Investigated different solutions for the physical layer performance of indoor UWB systems.
- Devised and implemented an indoor UWB (Ultra WideBand) channel model based on simple observations of statistics of the time evolution of multipath in space.
- Developed and implemented a model to assess the interference effects of UWB transmitter to existing cellular systems.
- Proposed, analysed, and implemented techniques for using adaptive (smart) antennas in cellular wideband radio systems at both the base station and the mobile station. Among others the MRC (Maximum ratio Combining), OC (Optimum Combining), EGC (Equal Gain Combining) weighting were investigated together with downlink beamforming based on uplink channel estimates.
- Developed and implemented a "snap-shot" system level simulator for evaluating the capacity and coverage improvement obtained with smart-antennas in WCDMA systems.
- Derived simplified equations for computing the interference factor that takes into account the carrier signal improvement and interference suppression achieved with smart antennas.

At Ericsson Research I pursued research which main outcome is presented below:

- Investigated wideband and directional channels for UMTS and CDMA2000.
- Contributed profoundly, both individually and as a member of the Antenna Systems and Propagation group, to the development of directional channel models, among others to the COST259 directional channel model.
- Analysed and implemented signal processing techniques such as least squares, MMSE, MUSIC, SAGE and ESPRIT for directions of arrival, angular spread estimation and time delay estimation. Investigated first and second order statistics of measured channel impulse response. The analysis comprised hypothesis testing of different distribution an autocorrelation models that described both the short term and long term behaviour of the channel.
- Proposed a model that characterizes the fast fading behaviour in time domain and Doppler domain.
- Derived a correlation model for the fast fading parameter and the excess path loss that indicates that at higher path loss in excess of the free space loss, the probability for a more severe fading increases too.
- Proposed a characterization of short term fading of the wideband channel in terms of fading-delay profile by subscribing a specific fading parameter to each of the multipath components.
- Investigated the effects of filtering the WCDMA signals to bandwidths corresponding to CDMA2000 signals, its impact on the power delay profile, the number of resolvable multipaths, fading statistics and multipath correlation. Planned and conducted extensive RF propagation measurements for performance analysis of several systems such as GSM, UMTS, WLL, and HIPERLAN.
- Investigated the outdoor to indoor propagation using both directional and omnidirectional antennas in order to properly quantify link budgets in different systems. Found that there is a high correlation between path loss and sometimes even shadow fading measured at 900 MHz through 5.2 GHz.
- Devised a new algorithm for UTD multiple diffraction that included slope diffraction modelling for macro-cell path loss prediction. The new algorithm increased computational efficiency by decreasing computation time and increasing accuracy; produced a corresponding computer program in Mathcad that was tested on canonical problems.

- Produced software in Matlab for simulating link level performance of WCDMA RAKE receiver using Maximum Ratio Combining.
- Devised a simple wideband channel model for the RAKE receiver characterization. Investigated the multipath diversity gain as function of the system bandwidth and rms delay spread of the channel for different combining algorithms as function of the mobile speed, antenna polarization and directivity.
- Discovered a relationship between the number of RAKE fingers required gathering a given share of the total power available at the WCDMA receiver and the product of the system bandwidth times the rms delay spread of the channel.
- Discovered a relationship between the fading width of the RAKE-combined signal at a given probability level and the product of the system bandwidth times the rms delay spread of the channel.
- Derived probabilistic models for predicting both the number of required RAKE fingers and the fading gain in different propagation environments.
- Derived a model for the first derivative of the envelope of a WCDMA signal for designing receiver Automatic Gain Control algorithms.
- Proposed a method for mobile speed estimation based on both first and second order statistics of received WCDMA signals. The findings of these investigations were summarized in technical reports and presented to corresponding WCDMA business unit members that used them in the development of WCDMA products as well as input to 3GPP standardization.
- Derived a mathematical model for the building shielding loss as function of the angle of arrival as seen at a receiver position inside a building to model interference from NGSO MSS and WLAN at 5 GHz. The model considered the signal attenuation properties of different materials of the windows, doors, floors and interior and exterior walls. The geometrical shape of the buildings was taken in consideration too.
- Proposed and lead a measurement campaign in order to experimentally quantify the expected building shielding loss in urban/suburban environments. During the measurements the satellite was emulated by a transmitter mounted on a helicopter that flew over the building of interest.
- Devised a new modelling approach that took into account diffraction losses above the last rooftop of a building; by this mean increasing the accuracy of the predicted losses.
- Analysed the performance of polarization diversity for GSM1800 pico-cells.
- Planned, devised and conducted the indoor propagation measurements using my own-developed LabVIEW code that controlled a DAQ system, RF switches and Spectrum Analyser.
- Devised a CW indoor propagation model with focus on fading statistics for different polarizations and signal cross-correlation as function of spatial orientation of the BS antennas.
- The findings on the fading gain and signal quality improvement obtained by different antenna configurations were employed by the business unit dealing with GSM indoor solutions.
- Derived a theoretical model for the performance analysis of perfect matched layer boundary condition.
- Produced FDTD computer programs in FORTRAN for near-field performance evaluation of handset antennas and SAR calculation.
- Evaluated the performance of perfect matched layer boundary conditions in commercial XFDTD codes by comparing it to other absorbing boundary conditions in terms of computational burden, efficiency and accuracy.

3GPP Standardization contributions

[50] Communication Performance Measurements for 3G User Equipment Including the Antenna, (R4-020074), TSG-RAN Working Group 4 (Radio) meeting #21, Sophia-Antipolis, France, 28th January-1st February 2002.

[51] Standard Test Procedure for 3G User Equipment Antenna Performance: Uncertainty assessment, TRP Measurements and Typical Use Positions, (R4-020743), TSG-RAN Working Group 4 (Radio) meeting #23, Gyengju, Korea, 13th- 17th May 2002.

[52] UE antenna efficiency impact on UMTS system/coverage capacity, (R4-030546), 3GPP, TSGRAN Working Group 4 (Radio) meeting #27, Paris, France 19th-23rd May 2003. (2)

[53] UE antenna efficiency- a comparison of different figures of merit, (R4-030994), TSG-RAN Working Group 4 (Radio) meeting #29, San Diego, US, 17th-21st Nov 2003.

[54] Measurements of Radio Performances of UMTS Terminals in Speech Mode, (R4-040612), 3GPP TSG-RAN Working Group 4 (Radio) meeting #33, Yokohama, 15 - 19 Nov 2004.

[55] On the UE antenna Efficiency Performance Requirements," (R4-050468), 3GPP TSG-RAN Working Group 4 (Radio) meeting #35, Athens, Greece, 9-13 May 2005.

[56] Updated TR on Antenna Performance," (GP-051461), 3GPP TSG-GERAN meeting #25, Montreal, Canada, 20 - 24 Jun 2005.

[57] Introducing MS antenna performance requirements in the specs, (GP-052127), 3GPP TSG GERAN1 #26, Schaumburg, Illinois, USA, August 29th - September 2nd, 2005.

[58] Introducing UE antenna performance requirements into 25.101, (R4-050904), 3GPP TSG-RAN WG4 Meeting #36, London, UK, August 29th - September 2nd, 2005.

ITU Standardization contributions

[59] ITU-R, WP-3K/36, 3M/117, Average building attenuation for indoor to satellite interference propagation at 5 GHz, Apr 23, 1999.

[60] ITU-R, WP-3K/69, 3M/153, Building attenuation loss measurements at the 5GHz in an office building area, May 29, 2000.

Openly available reports at arXiv:

[61] A. Alayon Glazunov. An Energy-Efficient MIMO Algorithm with Receive Power Constraint. arXiv: 1205.0927 [cs.IT], 4 May 2012.(1)

[62] A. Alayon Glazunov and J. Zhang. A note on the bivariate distribution representation of two perfectly correlated random variables by Dirac's δ-function. arXiv: 1205.0933v1 [cs.NI], 4 May 2012.

3.7 Other scientific leadership or development work that you want to highlight.

Expert Member of COST IC1004 (Cooperative Communications for Green Smart Environments)

Mobile handset joint measurement campaign with AMC Centurion, Stockholm, Sweden (2002- 2005)

4. PEDAGOGICAL ACHIEVEMENTS

4.1 Account of own pedagogical experience.

Since the start of 2007, I have been involved in teaching (in Swedish and in English), course development and examination. This includes giving lectures, laboratory supervision, and master thesis supervision, doctoral thesis supervision, lecturing in problem-solving seminars and the development of course material.

Currently, I am teaching at the undergraduate and the graduate course levels. The number of students has varied from 8 to over 100 the latter in first-year courses at the Electrical Engineering Program.

My teaching experience has been acquired at Lund University and KTH Royal Institute of Technology.

At Lund University I was involved as a teaching assistant in “Electromagnetics and Electronics”, “Electronics” and “Electronics Laboratory”.

At KTH my involvement and responsibilities have grown from being a teaching assistant in “Electromagnetic Field Theory” and the “Wave Propagation and Antennas” courses to being a guest teacher in the graduate course “Applied Antenna Theory” and the main teacher of the undergraduate course in “Electrical Circuit Analysis, Extended Course” and the main teacher of the “Principles of Wireless Propagation Channels” at the graduate level.

2013

- Teacher and course responsible for the course “Principles of Wireless Propagation Channel Modeling”, EI2423, 7.5 ECTS, KTH
- Teacher and course responsible for the course “Electrical Circuit Analysis, Extended Course”, EI1110, 9.0 ECTS, KTH
- Teacher in the course ”Applied Antenna Theory”, EI2400, 7.5 ECTS, KTH

2012

- Teacher in the course ”Applied Antenna Theory”, EI2400, 7.5 ECTS, KTH
- Teaching Assistant in the course “Electromagnetic Field Theory”, EI1200, 7.5 ECTS, KTH
- Teaching Assistant in the course “Wave Propagation and Antennas”, EI1210, 7.5 ECTS, KTH
- MS student supervision: Tobias Wall-Horgen and Erik Johannes Aagaard Fransson co-supervised with Peter Fuks, Building and Evaluating a 3D Scanning System for Measurements and Estimation of Antennas and Propagation Channels, 2012 (KTH, 30 ECTS)

2011

- Teacher in the course ”Applied Antenna Theory”, EI2400, 7.5 ECTS, KTH
- Teaching Assistant in the course “Wave Propagation and Antennas”, EI1210, 7.5 ECTS, KTH
- MS student supervision: Alaleh Mashkouri Najafi co-supervised with Jonas Medbo, Indoor Propagation Path Loss Measurements and Empirical Models for 2.44 GHz, 2011 (KTH and Ericsson, 30 ECTS)

2008

- Teaching Assistant in the course “Electromagnetics and Electronics”, ETE115, 7.5 ECTS, Lund University
- Teaching Assistant in the course “Electronics”, ETE022, 7.5 ECTS, Lund University
- Teaching Assistant in the course “Electronics Laboratory”, ETIA01, 7.5 ECTS credits, Lund University

2007

- Teaching Assistant in the course “Electromagnetics and Electronics”, ETE115, 7.5 ECTS, Lund University
- Teaching Assistant in the course “Electronics”, ETE022, 7.5 ECTS, Lund University
- Teaching Assistant in the course “Electronics”, ETE190, 7.5 ECTS, Lund University

2005

- MS .student supervision: Prasad Sathyaveer and Ramachandran Prasadh, Measurements and Comparison of In-Network MEG, TSFM-MEG and TRP of GSM Handsets, 2005 (HiG and Telia, 30 ECTS)
- MS student supervision: Ying Wang co-supervised with Per Zetterberg, Analysis of CW MIMO Channel Measurements in Urban Cellular Scenarios, 2005 (KTH and Telia, 30 ECTS)

2002

- MS student supervision: Karl Gerhardsson, Application and GPRS evaluation tool, 2002 (KTH and Telia, 30 ECTS)

2000

- MS student supervision: Lennart Hamberg co-supervised with Jonas Medbo, Study of wave propagation into buildings and validation of building-shielding loss models in the 5GHz band, 2000 (UU and Ericsson, 30 ECTS)

4.2 Personal pedagogical ideas about undergraduate and postgraduate teaching.

I adhere to the idea of research and teaching being two sides of the same coin that complement each other. Therefore, I believe students benefit from my research, in a similar degree, as I benefit from their inquisitiveness. By this I mean that teaching is an integral part of a successful academic life and it is a great opportunity not only to meet students to pass them my knowledge, but also to learn from them how to become a better teacher; it is a dynamic reciprocal process. I believe it is important to teach subjects that you are passionate about, but it might be even more important to become passionate about what you teach. As a teacher I have the opportunity to guide students’ discoveries and learn in the process too. I would be most interested in teaching classes in the area of antennas and propagation, electromagnetic theory and wireless channel modeling by combining rigorous theoretical developments with laboratory exercises.

I have strong inclination towards working with students individually as an advisor for master and doctoral studies. It represents an opportunity to help advancing research that I might be pursuing myself or research that I may not have time to explore but that can be enriched with the new ideas that the students will bring. Whenever the opportunity has presented itself I have been very active in

giving advice and helping undergrads and grad students with technical suggestions and ideas as well as helping them to refine and explain their projects.

I believe, the supervisor's roles for master and doctoral theses have similarities, but also clear differences. The output shall be of a high scientific standard in both cases. One of the main differences is that, at the master level, the time of the project is limited to a much shorter period of time and it generally reflects the outcome of a single project. Therefore, the problem posed should be of a more accessible nature. The time limitations allow less freedom to test different approaches to solve the problem at hand. Here, the supervisor usually provides a well-defined problem with more or less clear hints on how to find a solution. At the PhD level, the main goal is also to formulate a relevant research problem. This should be done by the supervisor at the beginning of the studies, since he or she is an expert in the subject and the responsible for introducing the student in the world of scientific thinking. As time evolves, the PhD student should acquire more confidence and be able to redefine some of the initial goals and the methods used in the analysis if he or she finds a new path, that of course in close consideration with the supervisor. The supervisor's role is to give guidance and to keep progress on track as a project leader too. Clearly, different students require different amounts of supervision. However, the supervisor's role is to give hands on support, encouragement and he or she should have a keen eye in order to judge the student's achievements. In this way the supervisor will make it possible for the student to reach the final goal, which is to produce new knowledge for himself and his peers on the chosen research topic. This will naturally lead to a successful thesis defense.

Another aspect of teaching that I enjoy is the development of new courses and the associated materials. I see this as an excellent opportunity to develop new ways to teach a subject in the process of organizing it for presentation. I believe that handing out lecture notes, promotes freedom and flexibility, since then I do not need to focus on covering my notes. With handouts, alternative derivations can be provided and discussed without the need of going into the details of everyone. I think that planning out homework assignments, quizzes, and projects with care are essential to eliminate busywork and errors. In turn this will help to improve clarity allowing students to get right to the heart of the problems in order to achieve the intended learning outcomes.

I believe that a balanced mix of regular lectures and self-studies is a good teaching approach at the graduate level, especially at the doctorate level. Working independently helps to foster critical thinking and inquiry. Examinations based on a series of project assignments can also help to this purpose. Both independent and collaborative moments can be integrated into the assignments. However, the major time should be spent by the students doing the problem solving individually. Making the students more active during the courses is an important goal for me. This can be achieved by means of examination procedures, for example introducing conceptual questions in the bachelor level courses. For example, when I designed the ordinary exam for the Electrical Circuits Analysis I tried to formulate some of the problems in such a way that the student that clearly understands the concepts would solve the problem using fewer steps than otherwise.

4.3 Own teaching effort at undergraduate and postgraduate level.

***Teacher*:**

Electrical Circuit Analysis, Extended Course, EI1110, 9.0 ECTS, KTH, autum 2013
Principles of Wireless Propagation Channel Modeling, EI2423, 7.5 ECTS, KTH, spring 2013
Electrical Circuit Analysis, Extended Course, EI1110, 9.0 ECTS, KTH, spring 2013 (I was involved in the second part corresponding to 5.0 ECTS)
Applied Antenna Theory, EI2400, 7.5 ECTS, KTH, spring 2013
Applied Antenna Theory, EI2400, 7.5 ECTS, KTH, spring 2012
Applied Antenna Theory, EI2400, 7.5 ECTS, KTH, spring 2011

***Teaching Assistant*:**

Electromagnetic Field Theory, EI1200, 7.5 ECTS, KTH, Fall 2012
Wave Propagation and Antennas, EI1210, 7.5 ECTS, KTH, Spring 2012
Wave Propagation and Antennas, EI1210, 7.5 ECTS, KTH, Spring 2011
Electromagnetics and Electronics, ETE115, 7.5 ECTS, Lund University, Spring 2008
Electronics, ETE022, 7.5 ECTS, Lund University, Spring 2008
Electronics Laboratory, ETIA01, 7.5 ECTS credits, Lund University, fall 2008
Electromagnetics and Electronics, ETE115, 7.5 ECTS, Lund University, Fall 2007
Electronics, ETE022, 7.5 ECTS, Lund University, Fall 2007
Electronics, ETE190, 7.5 ECTS, Lund University, Spring 2007

4.4 Design of own course materials list these, including their scope.

I have designed a new course from scratch and produced the corresponding materials, e.g., hand-outs and home assignments: “Principles of Wireless Propagation Channel Modeling”, EI2423, 7.5 ECTS. This is the first course of its kind given at KTH.

I have produced my own material in the form of lecture notes, quizzes, home assignments and exams for the second part of the course “Electrical Circuit Analysis, Extended Course”, EI1110, 9.0 ECTS, KTH.

I produced parts of the material for the “Electronics Laboratory”, ETIA01, 7.5 ECTS credits, Lund University.

4.5 Own pedagogical education. (NA)

4.6 Pedagogical development effort.

I have produced all the materials and designed the course “Principles of Wireless Propagation Channel Modeling”, EI2423, 7.5 ECTS. This is the first course of its kind given at KTH.

4.7 Own pedagogical prizes awarded. (NA)

4.8 Own essays etc. of a popular science nature. (NA)

4.9 Academic supervising experience.

4.9.1 Degree project works. List names of students and their project titles, number of credit points awarded, and the year of each project.

I have supervised 8 MS students. Since some of the work was performed jointly by the students, this has resulted in 6 MS theses.

- Tobias Wall-Horgen and Erik Johannes Aagaard Fransson(co-supervised with Peter Fuks), Building and Evaluating a 3D Scanning System for Measurements and Estimation of Antennas and Propagation Channels, 2012 (KTH, 30 ECTS)
- Alaleh Mashkouri Najafi (co-supervised with Jonas Medbo), Indoor Propagation Path Loss Measurements and Empirical Models for 2.44 GHz, 2011 (KTH and Ericsson, 30 ECTS)
- Prasad Sathyaveer and Ramachandran Prasadh, Measurements and Comparison of In-Network MEG, TSFM-MEG and TRP of GSM Handsets, 2005 (HiG and Telia, 30 ECTS)
- Ying Wang (co-supervised with Per Zetterberg), Analysis of CW MIMO Channel Measurements in Urban Cellular Scenarios, 2005 (KTH and Telia, 30 ECTS)
- Karl Gerhardsson, Application and GPRS evaluation tool, 2002 (KTH and Telia, 30 ECTS)
- Lennart Hamberg (co-supervised with Jonas Medbo), Study of wave propagation into buildings and validation of building-shielding loss models in the 5GHz band, 2000 (UU and Ericsson, 30 ECTS)

4.9.2 Licentiate and/or doctoral students.

See enclosure in Appendix D "Handledning av forskarstuderande" for details.

I was the de-facto supervisor of Sathyaveer Prasad, i.e., the supervision of the project was without involvement of formal supervisors and has resulted in peer-reviewed publications. Prasad was at at Gävle University College, Sweden and KTH Royal Institute of Technology, Stockholm, Sweden.

The conference contribution [30] was a part in Prasad's "Licavhandling". I had full responsibility of the transition between Lic. to TeknDr resulting in the journal articles [10, 11].

4.9.3 Doctoral student(s) at present being supervised.

See enclosure in Appendix D "Handledning av forskarstuderande" for details.

I am a co-supervisor and de-facto supervisor of Cheng Fang who is a PhD student at Centre for Wireless Research, University of Bedfordshire, UK. I defined the project; I conducted the measurements together with Cheng Fang.

The project has so far resulted in three conference contributions [18, 19, 22].

4.10 Pedagogical merits gained from outside the academic sphere.

Conference presentations, technical meeting presentations, technical report writing.

4.11 Other pedagogic leadership or developmental work you wish to demonstrate. (NA)

4.12 Administration of education (for example an assignment as a director of studies and similar) and educational leadership. (NA)

5. OTHER ASSIGNMENTS

5.1 Administrative assignments.

5.1.1 Experience from unit leadership; indicate size of unit and duration. "Unit" refers to research group, section, department, etc.

- Research Team Leader at Telia Research working towards standardization of Over the Air (OTA) testing of mobile wireless devices. I managed a team of three people during one year. I proposed, defined and lead a two-staff project on handset antenna performance measurements. The objective was to measure radiated performance of commercially available handsets. Results were delivered to the business unit. Lead the design and implementation of a test bench for performance measurements of TCP/IP over GPRS.
- Succeeded in managing, co-editing and contributing to the final proposal of a method for measuring radio performances of UMTS/GSM terminals. This document is the foundation on which the 3GPP working-item on handset antenna performance test was initiated and led to a 3GPP standard specification.
- Succeeded in managing, editing and contributing to the chapter on Handset antenna performance measurements in COST273 final report. More than fifteen members from different institutions including both industry and academia provided more than sixty technical documents.
- Proposed and lead a measurement campaign on handset antenna performance together with AMC Centurion. The measurement campaign included also measurements with the Telia Scattered Field Method and real life measurements in an up and running network.
- Co-chaired (Swedish delegate and TeliaSonera expert representative) COST Action 273 SWG2.2 on terminal antenna performance measurements.

5.1.2 Membership of university boards or councils in the last 5 years. (NA)

5.1.3 Other professional assignments of an administrative nature. (NA)

5.2 Politically associated research assignments. (NA)

5.2.1 Membership of governmental research committees or subcommittees. (NA)

5.2.2 Membership of other boards or committees distributing research funds. (NA)

5.2.3 Other evaluations of Swedish or foreign applications for research funding (numbers per year in the last 5 years). (NA)

5.2.4 Member of an international research council, programs, committees or advisory groups. (NA)

5.2.5 Other expert and leadership assignments of significance.

Member of Board of Advisors at Softmotion Networks (2011-2012)

Softmotion Networks LLC was a start-up company that had developed an affordable stereoscopic 3D software platform capable of real time processing and presenting interactive, live, and on-demand True 3D video; thus making it readily available to any individual with access to the internet, a computer, and inexpensive pair of stereoscopic 3D glasses.

5.3 Own external contacts and/or other external activities.

Prof. Andreas F. Molisch, University of Southern California, U.S. [5, 6, 7, 8, 9, 27, 28, 29,30]
Prof. Mats Gustafsson, Lund University, Sweden, [5, 6, 7, 8, 27, 28]
Prof. Jie Zhang, University of Sheffield, U.K. ,[4, 16, 19, 21, 22, 23, 24, 25, 62]
Prof. Ben Allen, University of Bedfordshire, U.K., [15, 19, 20]
Prof. Gerhard Kristensson, Lund University, Sweden, [7, 27, 28]
Prof. Peter Händel, KTH Royal Institute of Technology, Sweden, [11, 12]
Asso. Prof. Fredrik Tufvesson, Lund University, Sweden, [6, 7, 8, 19, 20, 23, 27, 28, 29, 30]
Asso. Prof. Kjell Prytz, Gävle University College, [11]
Dr. Jonas Medbo, Ericsson Research, Sweden, [41, 43]
Dr. Ying Zhinong, SonyMobile, Sweden, [10]
Dr. Thomas Bolin, SonyMobile, Sweden, [11]
Dr. Guillaume delaRoche, MindSpeed Technologies, France, [15]
Mr. Jan-Erik Berg, Ericsson Research, Sweden, [41, 42, 44, 45]
Mr. Henrik Asplund, Ericsson Research, Sweden, [9, 44, 45]

5.3.1 Own joint efforts with industry, trade and business life. (NA)

5.3.2 Member of trade and industry and public authorities' boards. (NA)

5.3.3 Other work within the third assignment.

From 2003 to 2006 I was Advisor to VP on electromagnetic fields (EMF) issues at corporate level. Communicated presentations at meetings with Ericsson, SonyEricsson, Nokia and TCO Development executives. I held internal presentations to the members of the EMF group at TeliaSonera. I reported to VP on the current standardization status and latest research developments in the field of radiation measurements.

6. RESUME OF APPLICATION

6.1 Name.

Andrés Alayon Glazunov

6.2 Year of birth.

1969

6.3 Gender.

Male

6.4 Present position.

Researcher at Electromagnetic Engineering Department, School of Electrical Engineering, KTH Royal Institute of Technology since 1/10/2012.

6.5 First academic degree, year and university.

MS in Electrical Engineering (Engineering Researcher), Physical Electronics, 1994. Saint Petersburg State Polytechnic University, St. Petersburg, Russia. (Honors Thesis: 5.00/5.00, Weighted GPA: 4.75/5.00)

6.6 Doctoral degree, year and university.

PhD in Electrical Engineering, Radio Systems, Lund University, Lund, Sweden, 2009.

6.7 Conferment of the title of docent, year and university.

I will apply for the docent qualification in fall 2013.

I have passed the required course LH207V, Research Supervision, 3 ECTS at the KTH Learning Lab in June 2013.

6.8 Number of articles in periodicals with a referee system (last five-year-period).

9 journal papers have been published (h-index=9, g-index=15 from Google Scholar & Harzing's PoP.)

3 journal papers are under review in IEEE Transactions on Antennas and Propagation.

6.9 Number of doctoral students supervised.

1 student supervised and 1 student under supervision.

6.10 Pedagogical merits: brief summary.

I have taught 8 different courses at 2 universities in Sweden, spanning from first year undergraduate level to advanced graduate level. Least number of students is 8 and the maximum has been more than 100 in the lecture room. I'm the co-editor and author of one text book.

6.10 Other information.

I have 10 years of full time research experience in industry as a Research Engineer at Ericsson Research (1996-2001), as a Senior Research Engineer at Telia Research AB (2001-2003) and as a Senior Specialist in Antenna Systems and Propagation at TeliaSonera Sweden AB (2003-2006).
I have done 1 year as Postdoc at the University of Bedfordshire, U.K. (2009-2010). I have done 2 years of Postdoc at KTH Royal Institute of Technology, Sweden (2010-2012).

6.11 Own homepage and/or web-address

KTH (http://www.kth.se/en/ees/omskolan/organisation/avdelningar/etk)

LinkedIn (http://se.linkedin.com/in/alayonglazunov)