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Curriculum Vitae

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Degrees

Docent in Signal Processing and KTH, January 2007.

Ph.D. in E.E. “Antenna Array Signal Processing for High Rank Data Models”,
Royal Institute of Technology (KTH), Stockholm, January 2000.

Licentiate degree , “Sensor Array Processing for Scattered Sources”, KTH, 1997.

M.Sc. in C.S. (Civilingenjör, datateknik) Masters thesis in information theory, “Rank-
ing of Permutations for Permutation Modulation” at the department of E.E.,
Linköping Institute of Technology, 1991.

Main Occupations

2007— *Associate Professor* in signal processing, School of Electrical Engineering,
KTH.

2006—2007 *Researcher* in signal processing, School of Electrical Engineering,
KTH.

January—June 2006 *Paternal leave* 80% of my time.

2000—2006 *Research Associate* in signal processing, department of Signals, Sen-
sors and Systems, KTH.

1995—2000 *Ph.D. student* in signal processing, department of Signals, Sensors
and Systems, KTH.

Main interest: Mobile communications using array antennas.

1991—2000 *Employed* at Ericsson Telecom AB in Karlstad (currently Ericsson Infotech AB). On a leave since march 1995.

Main tasks: Development of tools and methods for source code verification and validation at the unit level. Course development and teaching (internally at Ericsson).

Buzzwords: Object orientation, C++, automatic test case generation.

1986—1991 *Student* in Computer Science and Engineering at Linköping Institute of Technology, specialization in telematics.

Major Research Grants

2010-2012 “Interference in wireless systems - Modelling, predicting, shaping and avoiding”, Swedish Research council (VR).

2007-2009 “Handling Radio Resources in Space, Time and Frequency”, Swedish Research council (VR).

2002-2005 “Resource Optimization in Wireless Systems”, Swedish Research council (VR).

Other Research Related Activities

- Member of the technical program committee for IEEE CAMSAP 2005, IEEE VTC 2007 Fall&2008 Fall, IEEE SAM 2008, IEEE IWCLD 2009, IEEE WDN 2010 and IEEE SPAWC 2007-2010
- Track chair for EUSIPCO 2010.
- Publication chair for IEEE CAMSAP 2007.
- Member of the grading committee at the PhD defence of Darnal Palomar at Universitat Politècnica de Catalunya (UPC), Barcelona, Spain in June 2003, at the PhD defence of Mikael Coldrey and Maria Lanne at Chalmers University, Gothenburg, Sweden in April 2006 and May 2007, respectively, and at the PhD defence of Pablo Soldati at KTH February 2010.
- Faculty opponent at the PhD defence of Antti Tölli at Oulu University, Finland, April 2008.
- Faculty opponent at the Licentiate defence of Johannes Lindblom at Linköping University, May 2010.
- Main supervisor of 2 current PhD students.
- Assistant supervisor of Kai Yu (Ph.D 2005), Patrick Swedman (PhD 2007), David Hammarwall (PhD 2007), Karl Werner (PhD 2007) and Niklas Jaldén (PhD 2010) and 3 current PhD students.
- Regular reviewer for several journal, including IEEE Trans. SP, SP Letters, Comm. Letters, Trans Comm., Trans. Wireless Comm. and Trans. AP.
- 2007 Senior member IEEE
- 2007–2009 Associate editor for IEEE Transactions Signal Processing.
- 2007– Member of the IEEE Signal Processing for Communications (SP-COM) technical committee.
- 2006 Lecturer, together with Björn Ottersten, at EUSIPCO 2006.
- 2005— Secretary and treasurer in IEEE Swedish chapter of Signal Processing.

Others

- 1996—2003 Member of the board of bostadsrättsföreningen Stockholmshus nr. 7.
- 1992—2005 Secretary of Bergslagens Kammarsymfoniker.
- 1993—1995 Studies in Baroque music interpretation, Malmö Academy of Music, 40 credits.
- Violin player in several orchestras and chamber music ensembles. Alternating leader of the violin section in, among others, Bergslagens Kammarsymfoniker, Orkestern Filialen and Karlstads Orkesterförening.

Publications

14 refereed journal papers, 3 book chapters, 55 refereed + 5 invited conference papers. In addition, co-author of a number of technical reports, among others in the SATURN (2000–2002) and WINNER I&II&+ (2004–2007) projects funded by the European Commission.

Peer Reviewed Journal Papers

- [1] Yongming Huang, Luxi Yang, Mats Bengtsson, and Björn Ottersten. A limited feedback joint precoding for amplify-and-forward relaying. *IEEE Transactions on Signal Processing*, 58:1347 – 1357, March 2010.
- [2] Alex B. Gershman, Nicholas D. Sidiropoulos, Shahram Shahbazpanahi, Mats Bengtsson, and Björn Ottersten. Convex optimization-based beamforming: From receive to transmit and network designs. *IEEE Signal Processing Magazine*, 27:62–75, March 2010.
- [3] Peter von Wrycza, M. R. Bhavani Shankar, Mats Bengtsson, and Björn Ottersten. Spectrum allocation for decentralized transmission strategies: Properties of nash equilibria. *EURASIP Journal on Advances in Signal Processing*, April 2009.
- [4] Yong Zeng, Ying Fu, Mats Bengtsson, Xiaoshuang Chen, Wei Lu, and Hans Ågren. Finite-difference time-domain simulations of exciton-polariton resonances in quantum-dot arrays. *Optics Express*, 16(7):4507–4519, March 2008.
- [5] David Hammarwall, Mats Bengtsson, and Björn Ottersten. Acquiring partial CSI for spatially selective transmission by instantaneous channel norm feedback. *IEEE Transactions on Signal Processing*, 56(3):1188–1204, March 2008.
- [6] David Hammarwall, Mats Bengtsson, and Björn Ottersten. Utilizing the spatial information provided by channel norm feedback in SDMA systems. *IEEE Transactions on Signal Processing*, 56:3278–3293, July 2008.
- [7] Tùng T. Kim, Mats Bengtsson, Erik G. Larsson, and Mikael Skoglund. Combining long-term and low-rate short-term channel state information over correlated MIMO channels. *IEEE Transactions on Wireless Communications*, 7:2409–2414, July 2008.
- [8] C. Antón-Haro, P. Svedman, A. Alexiou, A. Gameiro, and M. Bengtsson. Cross-layer scheduling for multi-user MIMO systems. *IEEE Communications Magazine*, 44(9):39–45, September 2006.
- [9] Rickard Stridh, Mats Bengtsson, and Björn Ottersten. System evaluation of optimal downlink beamforming with congestion control in wireless communication. *IEEE Transactions on Wireless Communications*, 5(4):743–751, April 2006.
- [10] David Hammarwall, Mats Bengtsson, and Björn Ottersten. Downlink beamforming with indefinite shaping constraints. *IEEE Transactions on Signal Processing*, 54(9):3566–3580, September 2006.
- [11] Daniel Pèrez Palomar, Mats Bengtsson, and Björn Ottersten. Minimum BER linear transceivers for MIMO channels via primal decomposition. *IEEE Transactions on Signal Processing*, 53(8):2866–2882, August 2005.
- [12] Kai Yu, Mats Bengtsson, Björn Ottersten, Darren McNamara, Peter Karlsson, and Mark Beach. Modeling of wideband MIMO radio channels based on NLOS indoor measurements. *IEEE Transactions on Vehicular Technology*, 53(3):655–665, May 2004.

- [13] Mats Bengtsson and Björn Ottersten. A generalization of weighted subspace fitting to full rank models. *IEEE Transactions on Signal Processing*, 49(5):1002–1012, May 2001.
- [14] Mats Bengtsson and Björn Ottersten. Low-complexity estimators for distributed sources. *IEEE Transactions on Signal Processing*, 48(8):2185–2194, August 2000.

Book Chapters

- [1] Kai Yu, Mats Bengtsson, and Björn Ottersten. MIMO channel models. In Thomas Kaiser and et al., editors, *Smart Antennas – State-of-the-Art*, pages 271–292. Hindawi Publishing Corporation, 2005.
- [2] Björn Völcker, Mats Bengtsson, and Björn Ottersten. Spatially spread sources in antenna array processing. In Sathish Chandran, editor, *Adaptive Antenna Arrays: Trends and Applications*, pages 394–419. Springer Verlag, 2004.
- [3] Mats Bengtsson and Björn Ottersten. Optimal and suboptimal transmit beamforming. In Lal C. Godara, editor, *Handbook of Antennas in Wireless Communications*, chapter 18, pages 18–1 — 18–33. CRC Press, August 2001.

Theses

- [1] Mats Bengtsson. *Antenna Array Signal Processing for High Rank Data Models*. PhD thesis, Royal Institute of Technology, Stockholm, Sweden, December 1999. TRITA-S3-SB-9938.
- [2] Mats Bengtsson. Sensor array processing for scattered sources. Licentiate Thesis TRITA-S3-SB-9729, Signal Processing, Royal Institute of Technology, Stockholm, Sweden, December 1997.
- [3] Mats Bengtsson. Ranking of permutations for permutation modulation. Master’s thesis, LiTH-ISY-EX-1105. Dept. of EE, Linköping University, Sweden, March 1991. Also available as report LiTH-ISY-I-1214.

Peer Reviewed Conference Papers

- [1] Ahmed Farhan Hanif and Mats Bengtsson. Evaluation of low rate channel feedback schemes for MIMO systems. In *Proc. Future Network & Mobile Summit 2010*, June 2010.
- [2] Petri Komulainen, Antti Tölli, Bin Song, Florian Roemer, Emil Björnson, and Mats Bengtsson. CSI acquisition concepts for advanced antenna schemes in the WINNER+ project. In *Future Network and MobileSummit 2010 Conference Proceedings*, June 2010.
- [3] Yongming Huang, Luxi Yang, Mats Bengtsson, and Björn Ottersten. A multiuser downlink system combining limited feedback and channel correlation information. In *Proceedings IEEE International Conference on Communications*, May 2010.
- [4] Shengqian Han, Chenyang Yang, Mats Bengtsson, and Ana I. Pérez-Neira. Channel norm-based user scheduler in coordinated multi-point systems. In *Proceedings IEEE Global Telecommunications Conference*, December 2009.
- [5] Peter von Wrycza, M. R. Bhavani Shankar, Mats Bengtsson, and Björn Ottersten. A game theoretic approach to multi-user spectrum allocation. In *Proceedings IEEE Global Telecommunications Conference*, November 2009.

- [6] Yongming Huang, Luxi Yang, Mats Bengtsson, and Björn Ottersten. A limited feedback SDMA scheme with dynamic multiplexing order. In *IEEE International Workshop on Signal Processing Advances in Wireless Communications*, pages 211–215, June 2009.
- [7] Yongming Huang, Luxi Yang, Mats Bengtsson, and Björn Ottersten. A codebook-based precoding for dual-hop downlink with MIMO amplify-and-forward relaying. In *IEEE International Workshop on Signal Processing Advances in Wireless Communications*, pages 245–249, June 2009.
- [8] Mats Bengtsson. Spatial interference suppression for shared spectrum. In *Proceedings ICT Mobile and Wireless Communications Summit*, June 2008.
- [9] Emil Björnson, David Hammarwall, Randa Zakhour, Mats Bengtsson, David Gesbert, and Björn Ottersten. Feedback design in multiuser MIMO systems using quantization splitting and hybrid instantaneous/statistical channel information. In *Proceedings ICT Mobile and Wireless Communications Summit*, June 2008.
- [10] Peter von Wrycza, M. R. Bhavani Shankar, Mats Bengtsson, and Björn Ottersten. Game theoretic approach to spectrum allocation for weak interference systems. In *Proceedings IEEE Global Communications Conference*, pages 1–5, November 2008.
- [11] Peter von Wrycza, M. R. Bhavani Shankar, Mats Bengtsson, and Björn Ottersten. Spectrum allocation from a game theoretic perspective: Properties of nash equilibria. In *Proceedings Asilomar Conference on Signals, Systems & Computers*, October 2008.
- [12] Peter von Wrycza, Mats Bengtsson, and Björn Ottersten. Decentralized dynamic channel allocation for MIMO systems. In *Proceedings Asilomar Conference on Signals, Systems & Computers*, pages 1689 – 1693, November 2007.
- [13] David Hammarwall, Mats Bengtsson, and Björn Ottersten. Beamforming and user selection in SDMA systems utilizing channel statistics and instantaneous SNR feedback. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, April 2007.
- [14] Tüng T. Kim, Mats Bengtsson, and Mikael Skoglund. Quantized feedback design for MIMO broadcast channels. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, April 2007.
- [15] Peter Wrycza, Mats Bengtsson, and Björn Ottersten. On convergence properties of joint optimal power control and transmit-receive beamforming in multi-user MIMO systems. In *Proceedings IEEE International Workshop on Signal Processing Advances for Wireless Communications*, pages 1–5, July 2006.
- [16] Mats Bengtsson, Patrick Svedman, and Per Zetterberg. Comparison and cost analysis of smart and opportunistic MIMO OFDM schemes. In *Proceeding IST Mobile & Wireless Communications Summit*, June 2006.
- [17] Patrick Svedman, Leonard J. Cimini, Jr., Mats Bengtsson, Sarah Kate Wilson, and Björn Ottersten. Exploiting temporal channel correlation in opportunistic SD-OFDMA. *Proceedings IEEE International Conference on Communications*, June 2006.
- [18] Tüng T. Kim, Mats Bengtsson, Erik G. Larsson, and Mikael Skoglund. Combining short-term and long-term channel state information over correlated MIMO channels. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2006.

- [19] Peter Wrycza, Mats Bengtsson, and Björn Ottersten. MMSE criteria for downlink beamforming in CDMA wireless systems. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, volume 4, pages 813–816, May 2006.
- [20] Matteo Butussi and Mats Bengtsson. Low complexity admission in downlink beamforming. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2006.
- [21] David Samuelsson, Mats Bengtsson, and Björn Ottersten. Improved multiuser diversity using smart antennas with limited feedback. In *Proceedings European Signal Processing Conference*, September 2005.
- [22] Mats Bengtsson, Patrick Svedman, Xi Zhang, and Per Zetterberg. System comparison of smart and dumb antennas. In *Proceedings of VTC 2005 Spring*, June 2005.
- [23] Per Zetterberg, Niklas Jaldén, Kai Yu, and Mats Bengtsson. Analysis of MIMO multi-cell correlations and other propagation issues based on urban measurements. In *IST Mobile and Wireless Communications Summit*, March 2005.
- [24] David Samuelsson, Mats Bengtsson, and Björn Ottersten. An efficient algorithm for solving the downlink beamforming problem with indefinite constraints. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, March 2005.
- [25] Mats Bengtsson, Diego Bartolomé, José López Vicario, and Carles Antón-Haro. Beamforming and bit-loading strategies for multi-user SDMA with admission control. In *Proceedings of IEEE International Symposium on Personal, Indoor and Mobile Radio Communications*. IEEE, 2005.
- [26] Mats Bengtsson. From single link MIMO to multi-user MIMO. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*. IEEE, May 2004.
- [27] Patrick Svedman, Mats Bengtsson, and Björn Ottersten. Table based performance evaluation for HIPERLAN/2 systems - a multi-parameter design. In *Proceedings IEEE Vehicular Technology Conference, Spring*, May 2004.
- [28] Kai Yu, Mats Bengtsson, and Björn Ottersten. On the error of Kronecker structure based MIMO channel model. In *Proceedings of Nordic Radio Symposium*, August 2004.
- [29] David Samuelsson, Mats Bengtsson, and Björn Ottersten. Optimal downlink beamforming with additional constraints. In *Proceedings Asilomar Conference on Signals, Systems & Computers*, November 2003.
- [30] Mats Bengtsson. Pragmatic multi-user spatial multiplexing with robustness to channel estimation errors. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, volume IV, pages 820–823, April 2003.
- [31] Kai Yu, Mats Bengtsson, Björn Ottersten, Darren McNamara, Peter Karlsson, and Mark Beach. A wideband statistical model for NLOS indoor MIMO channels. In *Proceedings IEEE Vehicular Technology Conference, Spring*, volume 1, pages 370–374, May 2002.
- [32] Rickard Stridh, Mats Bengtsson, and Björn Ottersten. System evaluation of optimal downlink beamforming in wireless communication. In *Nordic Conference on Radio Science and Communications (RVK)*, pages 436–440, June 2002.

- [33] Mats Bengtsson. Multi-user spatial multiplexing — a pragmatic approach. In *Proceedings of RadioVetenskap och Kommunikation (RVK)*, Stockholm, Sweden, June 2002.
- [34] Mats Bengtsson. A pragmatic approach to multi-user spatial multiplexing. In *Proceedings of IEEE Sensor Array and Multichannel Signal Processing Workshop*, Rosslyn, VA, USA, August 2002. IEEE.
- [35] Kai Yu, Mats Bengtsson, Björn Ottersten, Darren McNamara, Peter Karlsson, and Mark Beach. A 20 MHz HIPERLAN/2 MIMO channel model in NLOS indoor scenarios. In *Nordic Conference on Radio Science and Communications (RVK)*, pages 311–315, June 2002.
- [36] Mats Bengtsson, Cristoff Martin, Björn Ottersten, Ben Slimane, and Per Zetterberg. Recent advances on MIMO processing in the SATURN project. In *Proc. IST Mobile Communications Summit*, June 2002.
- [37] Per Zetterberg, M. Bengtsson, D. McNamara, P. Karlsson, and M. A. Beach. Performance of multiple-receive multiple-transmit beamforming in WLAN-type systems under power or EIRP constraints with delayed channel estimates. In *Proceedings IEEE Vehicular Technology Conference, Spring*, May 2002.
- [38] Kai Yu, Mats Bengtsson, Björn Ottersten, Peter Karlsson, Darren McNamara, and Mark Beach. Measurement analysis of NLOS indoor MIMO channels. In *Proc. IST Mobile Communications Summit*, pages 277–282, Barcelona, Spain, 2001.
- [39] Kai Yu, Mats Bengtsson, Björn Ottersten, Darren McNamara, Peter Karlsson, and Mark Beach. Second order statistics of NLOS indoor MIMO channels based on 5.2 GHz measurements. In *Proceedings Global Telecommunications Conference*, volume 1, pages 156–160. IEEE, November 2001.
- [40] P. Zetterberg, M. Bengtsson, D. McNamara, P. Karlsson, and M.A. Beach. Downlink beamforming with delayed channel estimates under total power, element power and equivalent isotropic radiated power (EIRP) constraints. In *Proceedings of VTC Fall 2001*, volume I, pages 516–520. IEEE, October 2001.
- [41] Rickard Stridh, Mats Bengtsson, and Björn Ottersten. System evaluation of optimal downlink beamforming in wireless communication. In *Proceedings of VTC Fall 2001*, volume I, pages 343–347. IEEE, October 2001.
- [42] Mats Bengtsson and Björn Völcker. On the estimation of azimuth distributions and azimuth spectra. In *Proceedings of VTC Fall 2001*, volume 3, pages 1612–1615. IEEE, October 2001.
- [43] Mats Bengtsson. Jointly optimal downlink beamforming and base station assignment. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing*, volume V, pages 2961–2964, Salt Lake City, Utah, May 2001.
- [44] Mats Bengtsson. Robust and constrained downlink beamforming. In *Proceedings European Signal Processing Conference*, volume III, pages 1433–1436. EURASIP, September 2000.
- [45] Mats Bengtsson. Optimal transmission using smart antennas. In *Proc. IST Mobile Communications Summit*, pages 359–364, Ireland, October 2000.
- [46] Mats Bengtsson and Björn Ottersten. Optimal downlink beamforming using semidefinite optimization. In *Proc. 37th Annual Allerton Conference on Communication, Control, and Computing*, pages 987–996, September 1999.

- [47] Mats Bengtsson and Björn Ottersten. Downlink beamformer design using semidefinite optimization. In *Proceedings of RadioVetenskap och Kommunikation (RVK)*, pages 289–293, Karlskrona, Sweden, June 1999.
- [48] Mats Bengtsson, David Astély, and Björn Ottersten. Measurements of spatial characteristics and polarization with a dual polarized antenna array. In *Proceedings of VTC'99*, pages 366–370, Houston, Texas, USA, May 1999. IEEE.
- [49] Mats Bengtsson and Björn Ottersten. Uplink and downlink beamforming for fading channels. In *Proceedings of SPAWC'99, Signal Processing Advances in Wireless Communications*, pages 350–353, Annapolis, Maryland, USA, May 1999. IEEE.
- [50] Mats Bengtsson. A subspace fitting-like method for almost low rank models. In *Proceedings European Signal Processing Conference*, volume II, pages 1009–1013. EURASIP, 1998.
- [51] Mats Bengtsson and Björn Ottersten. On approximating a spatially scattered source with two point sources. In *Proc. NOR SIG'98*, pages 45–48, June 1998.
- [52] David Asztély, Mats Bengtsson, Martin Kristensson, and Björn Ottersten. Spatio-temporal processing for wireless communications. In *First Annual UCSD Conference on Wireless Communications*, San Diego, February 1998. UCSD.
- [53] Mats Bengtsson and Björn Ottersten. Rooting techniques for estimation of angular spread with an antenna array. In *Proceedings of VTC'97*, pages 1158–1162, May 1997.
- [54] Mats Bengtsson and Björn Ottersten. Signal waveform estimation from array data in angular spread environment. In *Proc. 30th Asilomar Conf. Sig., Syst., Comput.*, pages 355–359, November 1996.
- [55] Mats Bengtsson. The impact of local scattering on signal copy algorithms for antenna arrays. In *Proceedings of Nordiskt radioseminarium 1996 (NRS96)*, pages 24–27, August 1996.

Invited Conference Papers

- [1] Eduard Jorswieck, Mats Bengtsson, and Björn E. Ottersten. On the interplay between scheduling, user distribution, CSI, and performance measures in cellular downlink. In *Proceedings of EUSIPCO*, September 2006.
- [2] Per Zetterberg, Niklas Jaldén, and Mats Bengtsson. Analysis of multi-cell MIMO measurements in an urban macrocell environment. In *General Assembly of International Union of Radio Science (URSI)*, October 2005.
- [3] Kai Yu, Mats Bengtsson, Björn Ottersten, and Mark Beach. Narrowband MIMO channel modeling for LOS indoor scenarios. In *Proceedings XXVIIth Triennial General Assembly of the International Union of Radio Science (URSI)*, August 2002. Invited paper.
- [4] Björn Ottersten, Petre Stoica, David Astély, Mats Bengtsson, and Andreas Jakobsson. Spatio-temporal processing in wireless communications. In *RadioVetenskap och Kommunikation (RVK)*, pages 402–406, Karlskrona, Sweden, June 1999.
- [5] Mats Bengtsson and Björn Ottersten. Low complexity estimation of angular spread with an antenna array. In *Proceedings of SYSID'97*, pages 535–540. IFAC, July 1997.

Technical Reports (selected list)

- [1] Mats Bengtsson, Björn Ottersten, Otello Gasparini, and Enrico de Marinis. D541. link capacity and MIMO strategies for dual array systems. Technical report, Royal Institute of Technology, May 2002. IST-1999-10322 SATURN.
- [2] Per Zetterberg, Mats Bengtsson, D McNamara, P Karlsson, and M.A Beach. Performance of multiple-receive multiple-transmit beamforming in WLAN-type systems under power or EIRP constraints with delayed channel estimates. Technical report, Royal Institute of Technology, March 2002. IR-S3-SB-0202, available at www.s3.kth.se.
- [3] Mats Bengtsson, Kai Yu, and Björn Ottersten. D523, part 1. single and dual multi-sensor channel characterisation - analysis and models: Stochastic models. Technical report, Royal Institute of Technology, December 2001. IST-1999-10322 SATURN.
- [4] Per Zetterberg, Mats Bengtsson, D McNamara, P Karlsson, and M.A Beach. Down-link beamforming with delayed channel estimates under total power, element power and equivalent isotropic radiated power (EIRP) constraints. Technical report, Royal Institute of Technology, June 2001. SATURN, IR-S3-SB-0109, available at www.s3.kth.se.