

Mahesh K. Varanasi

Professor

Dept. of Electrical, Computer and Energy Engineering

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RESEARCH INTERESTS

Information theory, theory of communication, wireless communication, coding and system optimization, statistical/machine learning theory, and their applications.

EDUCATION

Ph.D., Electrical & Computer Engineering, Rice University, Houston, TX, May, 1989.

B.E. (University Gold Medallist) in Electronics and Communications Engineering, Osmania University, Hyderabad, India, 1984.

PROFESSIONAL EXPERIENCE

Professor, (2001-present), Department of Electrical Computer and Energy Engineering, University of Colorado, Boulder, CO.

Professor (by courtesy), (2010-present), Department of Mathematics, University of Colorado, Boulder, CO.

Affiliated Faculty, (2013-present), Department of Applied Mathematics, University of Colorado, Boulder, CO.

Associate Professor, (1996-2001), Department of Electrical & Computer Engineering, University of Colorado, Boulder, CO.

Assistant Professor, (1989-1996), Department of Electrical & Computer Engineering, University of Colorado, Boulder, CO.

Research Associate, (Summer 1989), ECE Department, Rice University, Houston, TX.

Research Assistant, (1985-1989), ECE Department, Rice University, Houston, TX.

Rice University Graduate Fellow, (1984-1985), ECE Department, Rice University, TX.

HONORS, AWARDS, etc.

- 2021 Qualcomm Faculty Award.
- 2019 Qualcomm Faculty Award.
- 2018 Qualcomm Faculty Award.
- 2017 Qualcomm Faculty Award.
- Fellow, IEEE
- Highly Cited Researcher (ISI Web of Science)

COURSES TAUGHT

Probability Theory
Linear Systems
Communication Theory
Probability and Random Processes
Digital Communications
Information Theory and Coding
Digital Signal Processing
Error Correcting Codes
Detection and Estimation Theory
Wireless Communications
Network Information Theory
Statistical Inference

Current PhD Students

Aniruddha Phatak
Altug Karakurk

Former Ph.D. Students

1. Mohamed Salman (Ph.D. ECEE, 2020, Systems Engineer at Qualcomm Inc., Boulder, CO)
2. Yimin Pang (Ph.D. ECEE, May 2019, Systems Engineer at Qualcomm Inc., San Diego, CA)
3. Yao Wang (Ph.D. ECEE, May 2017, Engineer at Google Inc., Boulder, CO)
4. Kaniska Mohanty (Ph.D. ECEE, 2016, Senior Engineer at Qualcomm Inc. San Diego, CA)
5. Henry P Romero (Ph.D., Applied Mathematics, 2014, Technical Staff, MIT Lincoln Labs)
6. Chinmay S. Vaze (Ph.D., 2012, Staff Engineer at Qualcomm Inc., San Diego, CA)
7. Sanjay Karmakar (Ph.D., 2012, Asst. Professor at NDSU, Fargo, ND)
8. Rajesh T. Krishnamachari (Ph.D., 2011, Global Head of Data Science, Merrill Lynch, New York).
9. S. G. Srinivasan (Ph.D. 2007, Senior Staff Engineer and Manager at Qualcomm Inc., San Diego, CA).
10. P. Dayal (Ph.D. 2005, Principal Engineer, Samsung Electronics, San Diego, CA).
11. N. Prasad (Ph.D., 2004, Principal Researcher, FutureWei Technologies, formerly Senior Research Staff Member at NEC Labs, NJ).
12. A. Kapur (Ph.D., 2003, Senior MTS at Cypress Semiconductor Corporation, formerly Wireless Principal Engineer Amazon Lab126, and Manager of Systems Design Engineering, Broadcom Inc. Sunnyvale, CA)

13. M. Brehler (Ph.D., 2002, Senior Director of Engineering, Qualcomm Inc, Boulder, CO)
14. Deepak Das (Ph.D., 2001, Vice President of Solutions at Federated Wireless, Boston, MA)
15. M. McCloud (Ph.D., 2000, Vice President Of Engineering at Qualcomm Inc., San Diego, CA.)
16. E. Fain (Ph.D., 1999, Director R&D, TCI Intl Inc. San Francisco, CA)
17. T. Guess (Ph.D., 1998, Qualcomm Inc. Boulder, CO, previously Asst. Professor, Univ of Virginia)
18. S. Vasudevan (Ph.D., 1993, Sr. Director & Bell Labs Fellow at Nokia Bell Labs).

Post-Doctoral Reseachers

1. M. Salman (2020)
2. H. Romero (2015, now at MIT Lincoln Labs)
3. Y. Jiang (2007-08, now Professor at Fudan University, China)
4. M. Brehler (2003, now Senior Director of Engineering at Qualcomm Inc., Boulder, CO)
5. M. McCloud (Research Associate, 2000-2001, now Vice President Of Engineering at Qualcomm Inc., San Diego, CA, previously Asst Professor, Univ Pittsburg, PA))
6. T. Guess (Research Associate, 1998-1999, Asst. Professor, Univ of Virginia, NSF CAREER Award, 2000, now at Qualcomm Inc. Boulder, CO))
7. G. Ricci (Research Associate, 1997-98, now full Professor at University of Leche, Italy)

Principal Advisor for MS or Degrees Awarded Elsewhere

1. H. Venkatachari (MS, 2006, CU),
 2. S. Torin (M.S. Dec 2000, Agilent Technologies, CA)
 3. A. Russ (Studentarbiet, 1996, U Erlangen, Germany, now at BMW, Munich, Germany)
 4. A. Russ (Diplomarbiet, 1997, U Erlangen, Germany, now at BMW, Munich, Germany)
 5. M. Brehler (Diplomarbiet, 1998, Tech Univ Munich, Germany)
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SERVICE (selected)

Chair, Faculty Search Committee, ECEE Department, 2020-21.

Member, ECEE Department Strategic Planning Committee, ECEE Department, 2020-21.

Member, ECEE Department Chair Search Committee, 2018-19.

Member, ECEE Open Search Committee, 2019-2020.

General Chair, IEEE Intl. Symp. Information Theory (ISIT), 2018.

Member, Interdisciplinary Faculty Search Committee, College of Engineering and Applied Sciences, University of Colorado, Boulder, 2017-18.

Associate Editor, IEEE Transactions on Information Theory, 2014-2020.

NSF Panelist (multiple times over several years)

Member, First Level Review Committee (a promotion and tenure committee), College of Engineering and Applied Sciences, University of Colorado, 2004-2007, 2011-present.

Editor, IEEE Transactions on Wireless Communications, 2007-2009.

Co-Organizer, Workshop on Random Matrix Theory and Wireless Communications, Chautauqua Park, Boulder, CO, Jul. 14-17, 2008.

Member, Executive Committee, ECE Dept, University of Colorado, Fall 2002-2007, Fall 2015-Spring 2018.

Chair, Faculty Search Committee, ECE Dept., University of Colorado, Boulder (2001-2002).

Member, Dean Search Committee, College of Engineering and Applied Sciences, University of Colorado, Boulder (2000-01).

Founding Member, Colorado Center for Information Storage (CCIS).

Upcoming Workshop/Conference Presentations

JOURNAL PUBLICATIONS

- [J100] Salman, Mohamed, and Mahesh K. Varanasi. "Diamond Message Set Groupcasting: From an Inner Bound for the DM Broadcast Channel to the Capacity Region of the Combination Network" submitted, *IEEE Transactions on Information Theory* (May, 2020), to be revised and resubmitted after review.
- [J99] Salman, Mohamed, and Mahesh K. Varanasi. "The K-User DM Broadcast Channel with Two Groupcast Messages: Achievable Rate Regions and the Combination Network as a Case Study" In Print, *IEEE Transactions on Information Theory* (2021), arXiv preprint arXiv:1812.10525 (2018, revised 2020).
- [J98] Salman, Mohamed, and Mahesh K. Varanasi. "Capacity Results for Classes of Partially Ordered K -User Broadcast Channels With Two Nested Multicast Messages." *IEEE Transactions on Information Theory* 66.1 (2019): 65-81.
- [J97] Pang, Yimin, and Mahesh K. Varanasi. "Constant-Gap-to-Capacity and Generalized Degrees of Freedom Regions of the MIMO MAC-IC-MAC." *IEEE Transactions on Information Theory*, 66.4 (2019): 2198-2218.
- [J96] Kaniska Mohanty and Mahesh K. Varanasi. "On the Generalized Degrees of Freedom of the MIMO Interference Channel with Delayed CSIT." *IEEE Trans. Information Theory* 65.5, 2019, pp. 3261 - 3277.
- [J95] Y. Pang and M. K. Varanasi, "A unified theory of multiple-access and interference channels via approximate capacity regions for the MAC-IC-MAC", *IEEE Transactions on Information Theory*, 65.3, 2019 pp. 1898 - 1920.
- [J94] Romero, Henry P., and Mahesh K. Varanasi. "Hierarchical successive group decoding achieves capacity in the multiple access channel with general message sets." *IEEE Transactions on Information Theory* 64.6 (2018): 4562-4580.
- [J93] Kaniska Mohanty and Mahesh K. Varanasi. "The Generalized Degrees of Freedom Region of the MIMO Z-Interference Channel with Delayed CSIT" *IEEE Transactions on Information Theory* 64.1 (2018): 531-546.
- [J92] D. Grant and Mahesh K. Varanasi, "Feasibility of Single-Beam Interference Alignment in Multi-Carrier Interference Channels," *IEEE Transactions on Information Theory* 63.11 (2017): 7352-7357.
- [J91] Yao Wang and Mahesh K. Varanasi, "Degrees of Freedom of the Two-User MIMO Broadcast Channel with Private and Common Messages Under Hybrid CSIT Models." *IEEE Transactions on Information Theory* 63.9 (2017): 6004-6019.
- [J90] H. P. Romero and M. K. Varanasi, "The K -User Vector Gaussian Multiple-Access Channel with General Messages Sets: Capacity, Polymatroidal Structure, and Efficient Computation," *IEEE Transactions on Information Theory*, Vol. 63, No. 6, 2017, pp. 3875-3893.
- [J89] Y. Wang and M. K. Varanasi, "Degrees of Freedom of the MIMO 2×2 Interference Network with General Message Sets," *IEEE Transactions on Information Theory*, Vol. 63, No. 5, 2017 pp. 3259-3276.
- [J88] H. P. Romero and M. K. Varanasi, "A Unifying Order-Theoretic Framework for Superposition Coding: Polymatroidal Structure and Optimality in the Multiple-Access Channel With General Message Sets," in *IEEE Transactions on Information Theory*, vol. 63, no. 1, pp. 21-37, Jan. 2017.
- [J87] K. Mohanty and M. K. Varanasi, "The Degrees of Freedom of the K -User MIMO Cyclic Z -Interference Channel Under Perfect and Delayed CSIT Assumptions," in *IEEE Transactions on Wireless Communications*, vol. 16, no. 1, pp. 17-25, Jan. 2017,

- [J86] K. Mohanty and Mahesh K. Varanasi. “Degrees of Freedom Region of the MIMO Z-Interference Channel With Mixed CSIT.” *IEEE Communications Letters* No. 20, Vol. 12, Dec. 2016, pp. 2422-2425.
- [J85] K. Mohanty and M. K. Varanasi, “Optimal Interference Alignment for the MIMO Z-Interference Channel with Delayed CSIT” *IEEE Commun. Letters*, December, 2015.
- [J84] S. Karmakar and M. K. Varanasi, “The Diversity-Multiplexing Tradeoff of the MIMO Z Interference Channel,” *IEEE Trans. Inform. Th*, No. 6, Vol. 61, Jun. 2015, pp. 3427 - 3445.
- [J83] C. S. Vaze and M. K. Varanasi, “The degrees of freedom of two-unicast layered MIMO interference networks with feedback,” *IEEE Trans. Inform. Th*, No. 6, Vol. 61, June 2015, 3316 - 3325.
- [J82] K. Mohanty, C. S. Vaze and M. K. Varanasi, “The Degrees of Freedom Region of the MIMO Interference Channel with Hybrid CSIT,” *IEEE Trans. Wireless Commun.*, No. 4, Vol. 14, April 2015, pp. 1837 - 1848.
- [J81] C. S. Vaze and M. K. Varanasi, “The Degrees of Freedom Region of the $2 \times 2 \times 2$ MIMO Interference Network,” *IEEE Trans. Inform. Th*, No. 12, Vol. 60, Dec. 2014, pp. 7751 - 7759.
- [J80] C. S. Vaze and M. K. Varanasi, “Independent signaling achieves the capacity region of the Gaussian interference channel with common information to within one bit,” *IEEE Trans. Inform. Th*, No. 10, Vol. 60, Oct. 2014, pp. 6070 - 6079.
- [J79] S. Limburg, D. Grant and M. K. Varanasi ”Higher genus universally decodable matrices (UDMG),” *Advances in Mathematics of Communications* (an American Mathematical Society journal), Vol. 8, No. 3, 2014, pp. 257-270.
- [J78] C. S. Vaze and M. K. Varanasi, “The degrees of freedom of MIMO networks with full-duplex receiver cooperation but no CSIT,” *IEEE Trans. Inform. Th*, No. 9, Vol. 60, Sept. 2014, pp. 5587 - 5596.
- [J77] R. T. Krishnamachari, M. K. Varanasi and K. Mohanty, “MIMO systems with quantized covariance feedback,” *IEEE Trans. Signal Processing*, Vol. 62, Issue 2, Jan. 2014, pp. 485-495.
- [J76] R. T. Krishnamachari and M. K. Varanasi, “On the geometry and quantization of manifolds of positive semidefinite matrices,” *IEEE Trans. Signal Processing*, Vol. 61, Issue 18, Sept. 2013, pp. 4587 - 4599.
- [J75] R. T. Krishnamachari and M. K. Varanasi, “Interference Alignment Under Limited Feedback for MIMO Interference Channels,” *IEEE Trans. Signal Processing*, Vol. 61, No. 15, Aug. 2013, pp. 3908-3917.
- [J74] H. P. Romero and M. K. Varanasi, “Bounds on the Capacity Region for a Class of Interference Channels with Common Information,” *IEEE Trans. Inform. Th*, No. 8, Vol. 59, Aug. 2013, pp. 4811-4818.
- [J73] C. S. Vaze and M. K. Varanasi, “The Degrees of Freedom Region of the MIMO Interference Channel with Shannon Feedback,” *IEEE Trans. Inform. Th*, No. 8, Vol. 59, Aug. 2013, pp. 4798 - 4810.
- [J72] S. Karmakar and M. K. Varanasi, “The Capacity Region of the MIMO Interference Channel and its Reciprocity to Within a Constant Gap,” *IEEE Trans. Inform. Th*, No. 8, Vol. 59, Aug. 2013, pp. 4781 - 4797.
- [J71] S. Karmakar and M. K. Varanasi, “The Diversity-Multiplexing-Tradeoff of the MIMO Half-Duplex Relay Channel,” *IEEE Trans. Inform. Th*, No. 12, Vol. 58, Dec. 2012, pp. 7168-7187.
- [J70] S. Karmakar and M. K. Varanasi, “The Generalized Degrees of Freedom Region of the MIMO Interference Channel,” *IEEE Trans. Inform. Th*, No. 12, Vol. 58, Dec. 2012, pp. 7188-7203.

- [J69] C. S. Vaze and M. K. Varanasi, "A New Outer-Bound via Interference Localization and the Degrees of Freedom Regions of MIMO Interference Networks with no CSIT," *IEEE Trans. Inform. Th.*, No. 11, Vol. 58, Nov. 2012, pp. 6853-6869.
- [J68] C. S. Vaze and M. K. Varanasi, "The Degrees of Freedom Regions of MIMO Broadcast, Interference, and Cognitive Radio Channels with No CSIT," *IEEE Trans. Inform. Th.*, Vol. 58, No. 8, Aug. 2012, pp. 5354-5374.
- [J67] C. S. Vaze and M. K. Varanasi, "The Degrees of Freedom Region and Interference Alignment for the MIMO Interference Channel with Delayed CSIT," *IEEE Trans. Inform. Th.*, Vol. 58, No. 7, Jul. 2012, pp. 4396-4417.
- [J66] S. Karmakar and M. K. Varanasi, "Diversity-Multiplexing Tradeoff of the Dynamic Decode-and-Forward Protocol for the MIMO Half-Duplex Relay Channel," *IEEE Trans. Inform. Th.*, Vol. 57 No. 10, Oct. 2011, pp. 6569-6590.
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- [J60] N. Prasad, M. K. Varanasi, L. Venturino and X. Wang, "An Analysis of the MIMO-SDMA Channel with Space-Time Orthogonal and Quasi-Orthogonal User Transmissions and Efficient Successive Cancellation Decoders," *IEEE Trans. Inform Th.*, Vol. 54, No. 11, Dec. 2008, pp. 5427-5446.
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- [J57] Y. Jiang and M. K. Varanasi, "Spatial multiplexing architectures with jointly designed rate-tailoring and ordered BLAST decoding Part II: A practical method for rate and power allocation," *IEEE Trans. Wireless Commun.*, Vol. 7, No. 8, Aug. 2008 pp. 3262-3271.
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- [J55] D. R. Grant and M. K. Varanasi, "The Equivalence of Space-Time Codes and Codes defined over Finite Fields and Galois Rings," *Advances in Mathematics of Communications (AMC)* (an American Institute of Mathematical Sciences (AIMS) Journal), Vol. 2, No. 2, May, 2008 pp. 131-145.
- [J54] N. Prasad and M. K. Varanasi, "Analysis and optimization of diagonally layered lattice schemes for MIMO fading channels," *IEEE Trans. Info. Theory*, Vol. 54, No. 3, Mar. 2008, pp. 1162-1185.

- [J53] D. R. Grant and M. K. Varanasi, "Duality theory for space-time codes over finite fields," *Advances in Mathematics of Communications (AMC)* (an American Institute of Mathematical Sciences (AIMS) Journal), Vol. 2, No. 1, Feb. 2008, pp. 35-54.
- [J52] S. Srinivasan and M. K. Varanasi, "Optimal spatial correlations for the noncoherent MIMO Rayleigh fading channel," *IEEE Trans. Wireless Comm.*, Vol. 6, No. 10, Oct 2007, pp. 3760-3769.
- [J51] D. Das and M. K. Varanasi, "Blind algorithms for joint optimization for multiuser receivers and power control," *IEEE Trans. Wireless Comm.*, Vol. 6, No. 8, Aug. 2007 pp. 3374-3383.
- [J50] A. Kapur, M. K. Varanasi and C. T. Mullis, "Signal Design for Bandwidth Efficient Multiple Access under Asymptotic Effective Energy Constraints" *IEEE Trans. Wireless Comm.*, Vol. 6, No. 8, Aug 2007 pp. 2837-2847.
- [J49] S. Srinivasan and M. K. Varanasi, "Constellation Design for the Noncoherent MIMO Rayleigh Fading Channel at General SNR," *IEEE Trans. Inform Th.*, Vol. 53, No. 4, April 2007 pp. 1572-1584.
- [J48] N. Prasad and M. K. Varanasi, "Outage Theorems for MIMO Block Fading Channels," *IEEE Trans. Info. Theory*, vol. 52, No. 12, Dec. 2006 pp. 5284-5296.
- [J47] M. K. Varanasi, C.T. Mullis and A. Kapur, "On the Limitation of Linear MMSE Detection," *IEEE Trans. Info. Theory*, vol. 52, No. 9, pp. 4282-4286, Sept. 2006.
- [J46] M. K. Varanasi and P. Dayal, "Unified Multi-Antenna Code Design for Fading Channels with Spatio-Temporal/Spectral Correlations," *IEEE Trans Wireless Comm.*, Vol. 5, No. 8, pp. 2266-2276, Aug. 2006.
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- [J44] P. Dayal and M. K. Varanasi "An optimal two transmit antenna space-time code and its stacked extensions," *IEEE Trans. Info. Theory*, vol. 51, No. 12, 4348-4355 Dec. 2005.
- [J43] A. Kapur, M. K. Varanasi and C.T. Mullis, "On the Limitation of Generalized Welch Bound Equality Signals," *IEEE Trans. Info. Theory*, vol. 51, No. 5, 2220-2224 Jun. 2005.
- [J42] P. Dayal and M. K. Varanasi, "Maximal Diversity Algebraic Space-Time Codes with Low Peak-to-Mean Power Ratio," *IEEE Trans. Inform. Th.*, vol. 51, No. 5, May 2005, 1691-1709.
- [J41] T. Guess and M. K. Varanasi, "Information-Theoretic Framework for Deriving Canonical Decision-Feedback Receivers in Gaussian Channels," *IEEE Trans. Inform. Th.*, vol. 51, No. 1, 173-187 Jan. 2005.
- [J40] P. Dayal, M. Brehler and M. K. Varanasi, "Leveraging Coherent Space-Time Codes for Non-coherent Communication via Training," *IEEE Trans. Inform. Th.*, vol. 50, No. 9, Sept 2004, pp. 2058-2080.
- [J39] D. Das and M. K. Varanasi, "Optimum Noncoherent Multiuser Decision Feedback Detection," *IEEE Trans. Inform. Th.*, vol. 50, No. 9, Sept 2004, pp. 1974-1988.
- [J38] F. Bandiera, G. Ricci and M. K. Varanasi, "Blind Multiuser Detection Over Highly-Dispersive CDMA Channels," *IEEE Trans. Commun.*, vol. 52, No. 8, Aug 2004, pp. 1377-1387.
- [J37] N. Prasad and M. K. Varanasi, "Analysis of Decision Feedback Detection for MIMO Rayleigh-Fading Channels and the Optimization of Power and Rate Allocations," *IEEE Trans. Inform. Th.*, vol. 50, No. 6, Jun 2004, pp 1009-1025.
- [J36] A. Kapur and M. K. Varanasi, "Multiuser Detection for Overloaded CDMA Systems," *IEEE Trans. Inform. Th.*, vol. 49, No. 6, Jun 2003, pp 1728-1742.
- [J35] M. Brehler and M. K. Varanasi, "Optimum Receivers and Low-Dimensional Spread Modulation for Multiuser Space-Time Communications," *IEEE Trans. Inform. Th.*, vol. 49, No. 4, Apr., 2003, pp 901-918.

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- [J32] M. L. McCloud, L. L. Scharf, M. K. Varanasi, "Beamforming, Diversity and Interference Rejection for Noncoherent Multiuser Communication over Fading Channels with a Receive Antenna Array," *IEEE Trans. Commun.*, vol. 51, No. 1, Jan. 2003, pp. 116-124.
- [J31] D. Das and M. K. Varanasi, "Blind Adaptive Multiuser Detection Using Stochastic Approximation with Averaging," *IEEE Journ. Selec. Areas Commun.*, vol. 20, No. 2, Feb. 2002, pp. 310-320.
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- [J28] M. K. Varanasi and D. Das, "Fast Stochastic Power Control for Nonlinear Multiuser Receivers," *IEEE Trans. Commun.*, Vol. 50, No. 11, Nov. 2002, pp. 1817-1827.
- [J27] G. Ricci, M. K. Varanasi and A. De Maio, "Blind Multiuser Detection via Interference Identification," *IEEE Trans. Commun.*, Vol. 50, No. 7, July 2002, pp. 1172-1181.
- [J26] A. Kapur, D. Das and M. K. Varanasi, "Noncoherent MMSE Multiuser Receivers and Their Blind Adaptive Implementations," *IEEE Trans. Commun.*, Vol. 50, No. 3, Mar. 2002, pp. 503-513.
- [J25] M. McCloud and M. K. Varanasi, "Modulation and Coding for Noncoherent Communications," *Journ. VLSI Signal Processing*, Special Issue on Signal Processing for Wireless Communications, vol. 30, No. 1/2/3, Jan/Feb/Mar. 2002 (invited paper), pp 35-54.
- [J24] M. Brehler and M. K. Varanasi, "Asymptotic Error Probability Analysis of Quadratic Receivers in Rayleigh Fading Channels with Applications to a Unified Analysis of Coherent and Noncoherent Space-Time Receivers," *IEEE Trans. Inform. Th.*, vol. 47, No. 6, September, 2001, pp. 2383-2399.
- [J23] E. Fain and M. K. Varanasi, "Group-Metric Multiuser Decoding," *IEEE Trans. Commun.*, vol. 49, No. 6, June 2001, pp. 1021-1032.
- [J22] M. K. Varanasi and T. Guess, "Bandwidth-Efficient Multiple-Access (BEMA): A New Strategy Based on Signal Design for Multiuser Receivers Under Quality-of-Service Constraints," *IEEE Trans. Commun.*, vol. 49, No. 5, May 2001, pp. 844-854.
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- [J17] E. A. Fain and M. K. Varanasi, "Diversity Order Gain for Narrowband Multiuser Communications with Pre-Combining Group Detection," *IEEE Trans. Commun.*, 48:4, Apr.2000, pp. 533-536.

- [J16] M. K. Varanasi and D. Das, "Noncoherent Decision Feedback Multiuser Detection," *IEEE Trans. Commun.* 48:2, Feb.2000, pp.259-269.
- [J15] M. K. Varanasi, "A Systematic Approach to the Design and Analysis of Optimum DPSK Receivers for Generalized Diversity Communications over Rayleigh Fading Channels," *IEEE Trans. Commun.* vol. 47, No. 9, Sept. 1999, pp 1365-1375.
- [J14] M. K. Varanasi, "Decision Feedback Multiuser Detection: A Systematic Approach," *IEEE Trans. Inform. Th.*, vol. 45, No. 1, Jan. 1999, pp. 219-240.
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- [I33] M. K. Varanasi, "A New Achievable Rate Region for the Broadcast Channel with General Message Sets," Proc. Information Theory and Applications (ITA) Workshop, UCSD, San Diego, CA (invited), Jan. 31- Feb. 5, 2016.

- [I33] M. K. Varanasi, "A unified order-theoretic view of the capacity region of the DM-MAC with general message sets," Proc. Information Theory and Applications (ITA) Workshop, UCSD, San Diego, CA (invited), Feb. 2-6, 2015.
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