

EE 599: Papers on Stochastic Network Optimization

I. INTRODUCTION

The papers listed below are representative of the area of stochastic network optimization. The first set of papers are on the topic of Lyapunov stability and optimization, which is central to the EE 599 course material. Other topics are also listed (mainly focusing on wireless networks) with a sample of papers provided, and may be helpful for course projects. Most papers can be found on author homepages and/or via Google. These sample papers are by no means exhaustive, nor are they necessarily up-to-date. More references can be found on Google.

II. PAPERS

A. Lyapunov Drift for Stability

- L. Tassiulas and A. Ephremides, "Stability Properties of Constrained Queueing Systems and Scheduling Policies for Maximum Throughput in Multihop Radio Networks," IEEE Trans. on Automatic Control, vol. 37, no. 12, Dec. 1992.
- L. Tassiulas and A. Ephremides, "Dynamic Server Allocation to Parallel Queues with Randomly Varying Connectivity," IEEE Trans. on Information Theory, vol. 39, pp. 466-478, March 1993.
- P. R. Kumar and S. P. Meyn, "Stability of Queueing Networks and Scheduling Policies," IEEE Trans. on Automatic Control, vol. 40, no. 2, pp. 251-260, Feb. 1995.
- N. McKeown, V. Anantharam, and J. Walrand, "Achieving 100% Throughput in an Input-Queued Switch," Proc. IEEE INFOCOM, 1996.
- N. Kahale and P. E. Wright, "Dynamic Global Packet Routing in Wireless Networks," Proc. IEEE INFOCOM, 1997.
- M. Andrews, K. Kumaran, K. Ramanan, A. Stolyar, and P. Whiting, "Providing Quality of Service over a Shared Wireless Link," IEEE Communications Magazine, vol. 39, no. 2, pp. 150-154, 2001.
- E. Leonardi, M. Mellia, F. Neri, and M. Ajmone Marsan, "Bounds on Average Delays and Queue Size Averages and Variances in Input-Queued Cell-Based Switches," Proc. IEEE INFOCOM, 2001.
- M. J. Neely, E. Modiano, and C. E. Rohrs, "Power Allocation and Routing in Multi-Beam Satellites with Time Varying Channels," IEEE Transactions on Networking, vol. 11, no. 1, pp. 138-152, Feb. 2003.
- M. J. Neely, E. Modiano, and C. E. Rohrs, "Dynamic Power Allocation and Routing for Time Varying Wireless Networks," IEEE Journal on Selected Areas in Communications, vol. 23, no. 1, pp. 89-103, Jan. 2005.

B. Lyapunov Drift for Performance Optimization

- M. J. Neely, E. Modiano, and C. Li, "Fairness and Optimal Stochastic Control for Heterogeneous Networks," Proc. IEEE INFOCOM, March 2005.
- M. J. Neely, "Energy Optimal Control for Time Varying Wireless Networks," IEEE Transactions on Information Theory, vol. 52, no. 7, July 2006.
- L. Georgiadis, M. J. Neely, and L. Tassiulas, Resource Allocation and Cross-Layer Control in Wireless Networks, Foundations and Trends in Networking, vol. 1, no. 1, pp. 1-149, 2006.
- M. J. Neely, "Super-Fast Delay Tradeoffs for Utility Optimal Fair Scheduling in Wireless Networks," IEEE Journal on Selected Areas in Communications, Special Issue on Nonlinear Optimization of Communication Systems, vol. 24, no. 8, pp. 1489-1501, August 2006.

C. Alternative Stochastic Network Optimization Techniques

- A. Eryilmaz and R. Srikant, "Fair Resource Allocation in Wireless Networks using Queue-Length-Based Scheduling and Congestion Control," Proc. IEEE INFOCOM, March 2005.
- A. Stolyar. "Maximizing Queueing Network Utility Subject to Stability: Greedy Primal-Dual Algorithm," Queueing Systems, vol. 50, pp. 401-457, 2005.
- J. W. Lee, R. R. Mazumdar, and N. B. Shroff, "Opportunistic Power Scheduling for Dynamic Multi-Server Wireless Systems," IEEE Transactions on Wireless Communications, vol. 5, no. 6, pp. 1506-1515, June 2006.

D. Convex Optimization for Static Networks

- F. Kelly, "Charging and Rate Control for Elastic Traffic," European Transactions on Telecommunications, vol. 8., pp. 33-37, 1997.
- F. P. Kelly, A. Maulloo, and D. Tan, "Rate Control for Communication Networks: Shadow Prices, Proportional Fairness, and Stability," Journal of the Operational Research Society, 49, pp. 237-252, 1998.
- S. H. Low and D. E. Lapsley, "Optimization Flow Control, i: Basic Algorithm and Convergence," IEEE/ACM Transactions on Networking, vol. 7(6): 861-75, Dec. 1999.
- S. H. Low, "A Duality Model of TCP and Queue Management Algorithms," IEEE Transactions on Networking, vol. 11(4), August 2003.
- L. Xiao, M. Johansson, and S. Boyd, "Simultaneous Routing and Resource Allocation for Wireless Networks," Proc. of the 39th Annual Allerton Conference on Communication, Control, and Computing, Oct. 2001.
- J. W. Lee, R. R. Mazumdar, and N. B. Shroff, "Downlink Power Allocation for Multi-Class CDMA Wireless Networks," Proc. IEEE INFOCOM, 2002.
- R. Cruz and A. Santhanam, "Optimal Routing, Link Scheduling, and Power Control in Multi-Hop Wireless Networks," Proc. IEEE INFOCOM, April 2003.
- M. Chiang, "Balancing Transport and Physical Layer in Wireless Multihop Networks: Jointly Optimal Congestion Control and Power Control," IEEE Journal on Selected Areas in Communications, vol. 1, no. 23, pp. 104-116, Jan. 2005.
- X. Liu, E. K. P. Chong, and N. B. Shroff, "A Framework for Opportunistic Scheduling in Wireless Networks," Computer Networks, vol. 41, no. 4, pp. 451-474, March 2003.
- B. Krishnamachari and F. Ordonez, "Analysis of Energy-Efficient, Fair Routing in Wireless Sensor Networks Through Non-Linear Optimization," IEEE Vehicular Technology Conference, Oct. 2003.

E. Imperfect Scheduling and Alternative Lyapunov Functions

- X. Lin and N. B. Shroff, "The Impact of Imperfect Scheduling on Cross-Layer Rate Control in Wireless Networks," Proc. IEEE INFOCOM, March 2005.
- X. Wu and R. Srikant, "Regulated Maximal Matching: A Distributed Algorithm for Multi-Hop Wireless Networks with Node-Exclusive Spectrum Sharing," IEEE Conf. on Decision and Control, 2005.
- X. Wu and R. Srikant, "Bounds on the Capacity Region of Multi-Hop Wireless Networks Under Distributed Greedy Scheduling," Proc. IEEE INFOCOM, April 2006.
- P. Chaporkar and K. Kar and S. Sarkar, "Throughput Guarantees Through Maximal Scheduling in Wireless Networks," Proc. of 43rd Annual Allerton Conf. on Communication, Control, and Computing, September 2005.
- D. Shah, "Maximal Matching Scheduling is Good Enough," Proc. IEEE Globecom, Dec. 2003.

- A. Mekittikul and N. McKeown, "A Practical Scheduling Algorithm to Achieve 100% Throughput in Input-Queued Switches," Proc. IEEE INFOCOM, 1998.
- M. J. Neely, "Order Optimal Delay for Opportunistic Scheduling in Multi-User Wireless Uplinks and Downlinks," Proc. of Allerton Conf. on Communication, Control, and Computing, Sept. 2006.

F. Multi-Receiver Diversity

- M. Zorzi and R. Rao, "Geographic Random Forwarding (GERAF) for Ad Hoc and Sensor Networks: Multihop Performance," IEEE Trans. on Mobile Computing, vol. 2, no. 4, Oct.-Dec. 2003.
- S. Biswas and R. Morris, "Exor: Opportunistic Multi-Hop Routing for Wireless Networks," Proc. of Sigcomm, 2005.
- F. Baccelli, B. Blaszczyszyn, and P. Muhlethaler, "An Aloha Protocol for Multihop Mobile Wireless Networks," IEEE Transactions on Information Theory, 2006.
- M. J. Neely, "Optimal Backpressure Routing for Wireless Networks with Multi-Receiver Diversity," Conference on Information Sciences and Systems (CISS), March 2006.

G. MIMO, Network Coding, Cooperative Transmission with Queues

- A. Khandani and J. Abounadi and E. Modiano and L. Zheng, "Cooperative Routing in Wireless Networks," Proc. of Allerton Conf. on Comm., Control, and Computing, pp. 1270-1279, Oct. 2003.
- C. Swannack, E. Uysal-Biyikoglu, and G. Wornell, "Low Complexity Multiuser Scheduling for Maximizing Throughput in the MIMO Broadcast Channel," Proc. of 42nd Allerton Conf. on Communication, Control, and Computing, September 2004.
- M. Kobayashi, G. Caire, and D. Gesbert, "Impact of Multiple Transmit Antennas in a Queued SDMA/TDMA Downlink," Proc. of 6th IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), June 2005.
- T. Ho and H. Viswanathan, "Dynamic Algorithms for Multicast with Intra-Session Network Coding," Proc. of 43rd Allerton Conf. on Communication, Control, and Computing, Sept. 2005.
- E. Yeh and R. Berry, "Throughput Optimal Control of Cooperative Relay Networks," Proc. of International Symposium on Information Theory, Adelaide, Australia, pp. 1206-1210, Sept. 2005.
- S. Katti and D. Katabi and W. Hu and H. Rahul and M. Medard, "The Importance of Being Opportunistic: Practical Network Coding for Wireless Environments," Proc. of 43rd Annual Allerton Conference on Communication, Control, and Computing, Oct. 2005.
- S. Bhadra and S. Shakkottai, "Looking at Large Networks: Coding vs. Queueing," Proc. IEEE INFOCOM, 2006.

H. Energy and Delay Optimality

- R. Berry and R. Gallager, "Communication Over Fading Channels With Delay Constraints," IEEE Transactions on Information Theory, vol. 48, no. 5, pp. 1135-1149, May 2002.
- M. Zafer and E. Modiano, "A Calculus Approach to Minimum Energy Transmission Policies with Quality of Service Guarantees," Proc. IEEE INFOCOM, March 2005.
- A. Fu and E. Modiano and J. Tsitsiklis, "Optimal Energy Allocation for Delay-Constrained Data Transmission over a Time-Varying Channel," Proc. IEEE INFOCOM, 2003.
- M. Goyal and A. Kumar and V. Sharma, "Power Constrained and Delay Optimal Policies for Scheduling Transmission over a Fading Channel," Proc. IEEE INFOCOM, 2003.

- M. A. Khojastepour and A. Sabharwal, "Delay-Constrained Scheduling: Power Efficiency, Filter Design, and Bounds," Proc. IEEE INFOCOM, March 2004.
- M. J. Neely, "Optimal Energy and Delay Tradeoffs for Multi-User Wireless Downlinks," Proc. IEEE INFOCOM, April 2006.
- W. Chen and U. Mitra, "Delay-Constrained Energy-Efficient Packet Transmissions," Proc. IEEE INFOCOM, April 2006.

I. Capacity and Delay Tradeoffs for Ad Hoc and Mobile Networks

- P. Gupta and P. R. Kumar, "The Capacity of Wireless Networks," IEEE Transactions on Information Theory, vol. 46, no. 2, pp. 388-404, March 2000.
- M. Grossglauser and D. Tse, "Mobility Increases the Capacity of Ad-Hoc Wireless Networks," IEEE/ACM Trans. on Networking, vol. 10, no. 4, pp. 477-486, Aug. 2002.
- M. J. Neely and E. Modiano, "Capacity and Delay Tradeoffs for Ad-Hoc Mobile Networks," IEEE Transactions on Information Theory, vol. 51, no. 6, pp. 1917-1937, June 2005.
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- X. Lin and N. B. Shroff, "Towards achieving the Maximum Capacity in Large Mobile Wireless Networks," Journal of Communications and Networks, Special Issue on Mobile Ad Hoc Wireless Networks, vol. 6, no. 4, Dec. 2004.
- G. Sharma and R. Mazumdar and N. Shroff, "Delay and Capacity Trade-Offs in Mobile Ad-Hoc Networks: A Global Perspective," Proc. IEEE INFOCOM, April 2006.

J. Network Pricing and Auctions

- J. Sun and E. Modiano and L. Zheng, "Competitive Fairness: Wireless Channel Allocation Using an Auction Algorithm," IEEE Journal on Selected Areas in Communications, 2006.
- J. Huang and R. Berry and M. Honig, "Auction-Based Spectrum Sharing," ACM/Kluwer Journal of Mobile Networks and Applications (MONET), special issue on WiOpt'04, to appear.
- T. Alpcan and T. Basar, "Distributed Algorithms for Nash Equilibria of Flow Control Games," Advances in Dynamic Games: Applications to Economics, Finance, Optimization, and Stochastic Control, Annals of Dynamic Games, vol. 7, pp. 473-498, 2005.
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- M. J. Neely, "Optimal Pricing in a Free Market Wireless Network," Proc. IEEE INFOCOM, May 2007.

K. Scheduling for the Low SINR Regime

- R. Cruz and A. Santhanam, "Optimal Routing, Link Scheduling, and Power Control in Multi-Hop Wireless Networks," Proc. IEEE INFOCOM, April 2003.
- B. Radunovic and J.-Y. LeBoudec, "Optimal Power Control, Scheduling, and Routing in UWB Networks," IEEE Journal on Selected Areas in Communications, vol. 22, no. 7, pp. 1252-1270, Sept. 2004.
- B. Radunovic and J.-Y. LeBoudec, "Power Control is not Required for Wireless Networks in the Linear Regime," Proceedings of WoWMoM, Taormina, Italy, June 2005.

L. Scheduling for the High SINR Regime

- D. Julian and M. Chiang and D. O'Neill and S. Boyd, "QoS and Fairness Constrained Convex Optimization of Resource Allocation for Wireless Cellular and Ad Hoc Networks," Proc. IEEE INFOCOM, 2002.
- M. Chiang, "Balancing Transport and Physical Layer in Wireless Multihop Networks: Jointly Optimal Congestion Control and Power Control," IEEE Journal on Selected Areas in Communications, vol. 1, no. 23, pp. 104-116, Jan. 2005.
- Y. Xi and E. M. Yeh, "Throughput Optimal Distributed Control of Stochastic Wireless Networks," Proc. of 4th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt), April 2006.

M. Low Complexity Algorithms

- L. Tassiulas, "Linear Complexity Algorithms for Maximum Throughput in Radio Networks and Input Queued Switches," Proc. IEEE INFOCOM, 1998.
- E. Modiano, D. Shah, and G. Zussman, "Maximizing Throughput in Wireless Networks via Gossiping," Proc. ACM Sigmetrics/IFIP Performance '06," June 2006.
- Y. Yi, G. de Veciana, and S. Shakkottai, "On Optimal MAC Scheduling with Physical Interference," Proc. of IEEE INFOCOM, 2007.