



Autonomous Multi-Agent Systems (Spring 2020)¹

Reading list (v3.0)

This document contains a list of papers, organized by topic, that we will study in class. We will not cover all the papers listed, likewise additional papers may be added by request. There is also a list of references that cover the background material in depth – if this is the first time you are encountering some of these topics, the references here have been chosen to be as broadly accessible as possible.

Note: All the material on this list should be freely accessible from within the Columbia network. If there are any issues obtaining access, please contact the instructor.

Topic 1: Network science?

- [1] **Collective dynamics of ‘small-world’ networks**, Watts & Strogatz, Nature 393, 440-442, 1998.
- [2] **Exploring complex networks**, Strogatz, Nature volume 410, pages268–276, 2001.
- [3] **The small-world phenomenon: An algorithmic perspective**, Kleinberg, Proceedings of the thirty-second annual ACM symposium on Theory of computing, 2000.
- [4] **Emergence of scaling in random networks**, Barabasi & Albert, Science, Vol. 286, Issue 5439, pp. 509-512, 1999.
- [5] **Towards a theory of scale-free graphs: Definition, properties, and implications**, Li et al, Internet Mathematics Vol. 2, Number 4, pp 431–523, 2005.
- [6] **A first-principles approach to understanding the internet’s router-level topology**, Li et al, SIGCOMM’04, pp 3–14.

Topic 2: Consensus and Averaging

- [7] **Consensus and cooperation in networked multi-agent systems**, Olfati-Saber, Fax, and Murray, Proceedings of the IEEE, Vol. 95, No. 1, 2007.
- [8] **Coordination of groups of mobile autonomous agents using nearest neighbor rules**, Jadbabaie, Lin, and Morse, IEEE Transactions on Automatic Control, Vol. 48, Issue, 6, 2003.et al.
- [9] **Flocking in fixed and switching networks**, Tanner, Jadbabaie, and Pappas, IEEE Transactions on Automatic Control, Vol. 52, Issue 5, 2007.
- [10] **Fast linear iterations for distributed averaging**, Xiao and Boyd, Systems & Control Letters 53, pp. 65–78, 2004.

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- [11] **Randomized gossip algorithms**, Boyd et al. IEEE/ACM Transactions on Networking, Vol. 14, pp. 2508–2530, 2006.
- [12] **A scheme for robust distributed sensor fusion based on average consensus**, Xiao, Boyd, and Lall, IPSN 2005. Fourth International Symposium on Information Processing in Sensor Networks, IEEE, 2005.
- [13] **Fastest mixing markov chain on a graph**, Boyd, Diaconis, and Xiao, SIAM Review, Vol. 46, No. 4, pp. 667–689, 2004. *n.b. the link is to a more readable “full” version of the paper*
- [14] **Graph weight allocation to meet laplacian spectral constraints**, Shafi, Arcak, and El Ghaoui, IEEE Transactions on Automatic Control, Vol. 57, No. 7, 2012.
- [15] **Geometric analysis of the formation problem for autonomous robots**, IEEE Transactions on Automatic Control, Vol. 55, No. 10, 2010.

Topic 3: Distributed control

- [16] **Controllability of multi-agent systems from a graph-theoretic perspective**, Rahmani et al., SIAM J. Control Optim, Vol. 48, No. 1, pp. 162–186, 2009.
- [17] **System Level Synthesis**, Anderson et al. Annual Reviews in Control, Vol. 47, pp. 365–393, 2019.
- [18] **A characterization of convex problems in decentralized control**, Rotkowitz and Lall, IEEE Transactions on Automatic Control, Vol. 51, No. 2, 2006.
- [19] **Convexity of optimal control over networks with delays and arbitrary topology**, Rotkowitz, Cogill, and Lall, Int. J. Systems, Control and Communications, Vol. 2, 2010.
- [20] **Design of optimal sparse feedback gains via the alternating direction method of multipliers**, Lin, Fardad, and Jovanovic, IEEE Transactions on Automatic Control, Vol. 58, Issue 9, 2013.
- [21] **H₂-optimal decentralized control over posets: A state-space solution for state-feedback**, Shah and Parrilo, IEEE Transactions on Automatic Control, Vol. 58, No. 12, 2013.
- [22] **Information structures in optimal decentralized control**, Mahajan et al. Proc. of the 51st IEEE Conference on Decision and Control, 2012.

Topic 4: Vehicle platoons

- [23] **An experimental study on the fuel reduction potential of heavy duty vehicle platooning**, Alam, Gattami, and Johansson, Proc. of the 13th International IEEE Annual Conference on Intelligent Transportation Systems, pp. 306–311, 2010.
- [24] **On the ill-posedness of certain vehicular platoon control problems**, Jovanovic and Bamieh, Vol. 50, Issue 9, 2005.
- [25] **Coherence in large-scale networks: Dimension-dependent limitations of local feedback**, Bamieh et al., IEEE Transactions on Automatic Control, Vol. 57, No. 9, 2012.
- [26] **Suboptimal decentralized controller design for chain structures: Applications to vehicle formations**, Alam, Gattami, and Johansson, Proc. of the 50th IEEE Conference on Decision and Control, 2011.

Topic 5: Internet congestion control

- [27] **Optimization flow control – I. Basic algorithm and convergence**, Low & Lapsley, IEEE/ACM Transactions on networking, Vol. 7, pp. 861– 974, 1999.
- [28] **Layering as optimization decomposition: A mathematical theory of network architectures**, Chiang et al. Proceedings of the IEEE, Vol. 95, No. 1, 2007.
- [29] **Analytical methods for network congestion control**, Low, Synthesis Lectures on Communication Networks 10.1, 2017.
- [30] **End-to-end congestion control schemes: Utility functions, random losses and ECN marks**, Kunniyur & Srikant, IEEE/ACM Transactions on Networking, Vol. 11, No. 5, 2003.

Topic 6: Power and energy

- [31] **A simple optimal power flow model with energy storage**, Chandy et al., Proc. of the 49th IEEE Conference on Decision and Control, 2010.
- [32] **Two market models for demand response in power networks**, Chen et al., First IEEE International Conference on Smart Grid Communications, 2010.
- [33] **Optimal power flow pursuit**, Dall’Anese & Simonetto, IEEE Transactions on Smart Grid, Vol. 9, No. 2, 2018
- [34] **Optimal decentralized protocol for electric vehicle charging**, Gan et al., IEEE Transactions on Power Systems, Vol. 28, No. 2, 2013.
- [35] **Efficiency-risk tradeoffs in electricity markets with dynamic demand response**, Huang, Roozbehani, and Dahleh, IEEE Transactions on Smart Grid, vol. 6, no. 1, 2105.
- [36] **Distributed control and optimization in DC microgrids**, Zhao & Dorfler, Automatica Vol. 61, 2015.
- [37] **Design and stability of load-side primary frequency control in power systems**, Zhao et al., IEEE Transactions on Automatic Control Vol. 59, No.5, 2014.
- [38] **Optimal placement of energy storage in the grid**, Bose et al., Proc. of the 51st IEEE Conference on Decision and Control, 2012.
- [39] **Synchronization and power sharing for droop-controlled inverters in islanded microgrids**, Simpson-Porco et al., Automatica, Vol. 49, 2013.

Optional topics – decided by student preference

- [40] **Analysis and optimization of randomized gossip algorithms**, Boyd et al., Proc. of the 43rd IEEE Conference on Decision and Control December, 2004.
- [41] **On the controllability of nearest neighbor interconnections**, Tanner, Proc. of the 43rd IEEE Conference on Decision and Control December, 2004.
- [42] **Controllability of a leader–follower dynamic network with switching topology**, Liu et al., IEEE Transactions on Automatic Control , Vol. 53, No. 4, 2008.

[43] **Learning fairness in multi-agent systems**, Jiang and Lu, Advances in Neural Information Processing Systems, 2019.

Background material

Specific chapters will be listed ahead of class.

- [i] **Lectures on dynamic systems and control**, Dahleh, Dahleh, and Verghese, MIT OpenCourseWare. *n.b. freely available thanks to MIT OpenCourseWare*
- [ii] **Feedback systems: An introduction for scientists and engineers**, Astrom and Murray, Princeton University Press. *n.b. freely available thanks to Prof Richard Murray through his website*
- [iii] **A course in robust control theory: a convex approach**, Dullerud and Paganini, Springer Verlag, 2000.
- [iv] **Convex optimization**, Boyd & Vandenberghe, Cambridge University Press, 2004. *n.b. the book and a full set of lecture notes and videos are freely available through the link provided*