ZHAOZHAN YAO

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EDUCATION

with the School of Automation, Guangdong University of Technology supervised by **Prof. Yong Xu**
M.Sc.in Control Science and Engineering Sept 2020 to present
B.Eng. in Automation, GPA: 4.0/5.0 (rank 1st in the major) Sept 2016 to Jun 2020

RESEARCH INTERESTS

Multiagent systems; Graph theory; Consensus; Multiconsensus; Finite-, fixed-, and predefined-time stability; Discontinuous control; Nonsmooth analysis; Sliding mode control; Backstepping control; Formation control; Attitude control and synchronization.

PUBLICATIONS

1. Yong Xu, **Zhaozhan Yao**, Renquan Lu, Bijoy K. Ghosh, A novel fixed-time protocol for first-order consensus tracking with disturbance rejection, *IEEE Trans. Autom. Control*, doi:10.1109/TAC.2021.3131549.
2. **Zhaozhan Yao**, Ye Kuang, Chang Liu, Yuru Guo, Hongxia Rao, A discontinuous finite-time consensus tracking algorithm for single integrator multi-agent system with external disturbance, *Proc. China Control Conf.*, 657-661, 2021.

RECENT RESEARCH

First-order predefined-time consensus under digraphs *Automatica*
Zhaozhan Yao, Yong Xu, Chang Liu, Renquan Lu, Bijoy K. Ghosh, *Life Fellow*, *IEEE* to be submitted

- This paper considers a group of scalar agents subject to nonlinear dynamics and bounded disturbances under strongly connected graphs, and describes two novel controllers to achieve consensus within an arbitrarily prespecified time.
- **A shortcoming of existing controller designs**: Most existing papers design controllers using some eigenvalue information of the Laplacian or its variants associaed with the communication topology, which, however, is global information since each agent has to own the knowledge of the communication topology as to comupte the eigenvalue.
- **An unorthdox controller design**: In the proposed controller, while the signum of the sum of the relative states of the agents w.r.t. their neighbors is still kept to guarantee consensusability, the magnitude of control inputs is designed via the self-states of the agents. This unorthodox practice, together with a matching Lyapunov function, removes the use of any eigenvalue information of the Laplacian or its variants in the consensus analysis, following a favored result that the control gains do not depend on any global information associated with the communication topology and agents achieve consensus in a fully distributed manner.

Finite-time multiconsensus with disturbance rejection in signed digraphs *IEEE Trans. Autom. Control*
Zhaozhan Yao, Yong Xu, Zijing Xiao, Hui Peng, Peng Shi, *Fellow*, *IEEE* under review

- This paper considers a group of scalar agents with bounded disturbances, and describes a discontinuous controller to achieve multiconsensus with disturbance rejection within a finite time.
- **A new multiconsensus scheme**: Agents won't achieve consensus when the underlying communication topology is weakly connected and, therefore, are partitioned into multiple cells. So, multiconsensus arises. Most recent papers study multiconsensus using external equivalent partitions that require all agents inside a cell to have the same indegree w.r.t. another one. However, this paper classifies the cells into independent ones and dependent ones, and finds that only a portion of agents inside each dependent cell obeys the external equivalence rule is already sufficient to guarantee multiconsensusability.
- **Easy-to-tune control gains**: An aesthetically pleasing tuning condition is derived and presents that the minimum control gain has to be twice as large as the upper bound of disturbances as to guarantee disturbance rejection. Still, the control gains do not depend on any global information associated with the communication topology.

A novel fixed-time protocol for first-order consensus tracking with disturbance rejection *IEEE Trans. Autom. Control*
Yong Xu, **Zhaozhan Yao**, Renquan Lu, Bijoy K. Ghosh, *Life Fellow*, *IEEE*

- **This paper overcomes such a problem**: given a group of scalar followers with bounded disturbances, a scalar leader, and a directed communication topology, how to achieve consensus tracking within a fixed time, in the presence of a moving leader with bounded control input, instead of a static leader.

AWARDS AND HONORS

- First Class Postgraduate Scholarship, awarded to the top 20% postgraduates of the school
- **National Scholarship**, awarded to the top undergraduate in the major
- honored Top Ten Graduates of the school
- Second Prize at China Undergraduate Mathematical Contest in Modeling

PROFESSIONAL SERVICE

- **Technical Manuscript Reviewer**: *Automatica* and *Neurocomputing*.

SKILLS

- **Programming**: Matlab: good; Python: familiar.