Unmanned Systems Planning and Control based on Bionic Swarm Movement

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This talk presents swarm control for self-organized system with fixed and switching topologies. The generation strategy, motion control law of a novel leader-follower relation-invariable persistent formation (RIPF), which is a kind of distance-based directed formation for multi-agent systems (MASs), will be discussed. An efficient algorithm is designed to find out if a persistent formation can be generated from a rigid graph. Derived from the properties of a rigid graph, an algorithm to generate a RIPF from any initial location is presented. The communication topology is automatically generated based on RIPF. With the selected minimum agent-movement RIPF, lastly, a control law is designed to drive this initial RIPF to the desired RIPF with given distances among agents. Simulation results show the proposed generative method, control law, and downward-tree are effective to realize the desired formation.

Short Bio for C. L. Philip Chen

C. L. Philip Chen is the Chair Professor and Dean of the College of Computer Science and Engineering, South China University of Technology. Being a Program Evaluator of the Accreditation Board of Engineering and Technology Education (ABET) in the U.S., for computer engineering, electrical engineering, and software engineering programs, he successfully architects the University of Macau's Engineering and Computer Science programs receiving accreditations from Washington/Seoul Accord through Hong Kong Institute of Engineers (HKIE), of which is considered as his utmost contribution in engineering/computer science education for Macau as the former Dean of the Faculty of Science and Technology. He is a Fellow of IEEE, AAAS, IAPR, CAA, and HKIE; a member of Academia Europaea (AE), European Academy of Sciences and Arts (EASA), and International Academy of Systems and Cybernetics Science (IASCYS). He received IEEE Norbert Wiener Award in 2018 for his contribution in systems and cybernetics, and machine learnings. He is also a 2018 highly cited researcher in Computer Science by Clarivate Analytics.

His current research interests include systems, cybernetics, and computational intelligence. Dr. Chen was a recipient of the 2016 Outstanding Electrical and Computer Engineers Award from his alma mater, Purdue University, after he graduated from the University of Michigan at Ann Arbor, Ann Arbor, MI, USA in 1985. He was the IEEE Systems, Man, and Cybernetics Society President from 2012 to 2013, and currently, he is the Editor-in-Chief of the IEEE Transactions on Systems, Man, and Cybernetics: Systems, and an Associate Editor of the IEEE Transactions on Fuzzy Systems, and IEEE Transactions on Cybernetics. Currently, he is a vice president of Chinese Association of Automation (CAA).