IEEE ICUS 2022
Invited Session Summary

Title of Session

UAV Swarm Network and Task Coordination Cluster System

Name, Salutation and Affiliation of Organizers

1. Prof. Tingting Zhang

Army Engineering University of PLA, China

2. Prof. Yi Mao

Hohai University, China

3. Assoc. Prof. Sicong Liu

Northwestern Polytechnical University, China

4. Assoc. Prof. Rui Sun

Nanjing University of Aeronautics and Astronautics, China

5. Assoc. Prof. Zhan Shi

Nanjing Institute of Technology, China

Biosketches of Organizers

Tingting Zhang, Ph.D., professor of Army Engineering University, part-time tutor of Nanjing University of Aeronautics and Astronautics, director of ACM sigcse China, and science and technology consulting expert of Jiangsu Province. She is a young and middle-aged scientific and technological leader of the "333 high-level talent training project" in Jiangsu Province and an army scientific and technological innovation talent. Her research fields include network information system of systems, complex system evolution analysis, autonomous collaboration of unmanned systems and strategy learning. She has presided over more than ten projects such as the National Natural Science Foundation of China and the science and Technology Commission of China. She published her monograph "Research on Network Information System of Systems capability evolution analysis", which was supported by the national science and Technology Publishing foundation. She has won the nomination Award for the first CICC excellent doctoral dissertation, 2 provincial and ministerial scientific and technological progress awards and 2 third prizes. Swarmflow, an unmanned system cooperative confrontation training platform developed by her, won the Excellence Award in the military software maker

competition. She has published more than 40 academic papers such as IEEE Trans and CCF class A. She has authorized 12 invention / national defense patents and won one silver award for invention patents in Geneva. Her deeds of "scientific research serving the grassroots" were reported by the people's daily, Xinhua news agency and other media.

Yi Mao, Ph.D., Professor, College of IoT, Hohai University. His research interest is in cooperative control of swarm systems, air traffic management and air battlefield management and control. He has published more than 20 papers in conferences/journals, such as Fundamental Research, Neural Computing and Applications, GPS Solutions, et al., and has authorized 8 Chinese and American patents; served as a member of the CICC ATC Committee. He has won the outstanding young scholars of CSAA, the Second Prize of Science and Technology in Jiangsu province, the Frist Prize of Science and Technology in CICC, the Second Prize of Science and Technology in CAAC and the Frist Prize of Science and Technology in CIE, et al.

Sicong Liu, Ph.D., Associate Professor, School of Computer Science, Northwestern Polytechnical University. Her research interest is in mobile & embedded systems, edge-end collaborative adaptive computation frameworks, and crowd intelligence with the deep fusion of human, machine, and things. She has published more than 20 papers in conferences/journals, such as CCF A-class conference ACM Ubicomp, mobile system top conference ACM MobiSys, CCF A-class journal TMC, et al., and has authorized 4 Chinese patents; served as a member of the CCF Ubiquitous Computing Committee, ACM SIGBED China Youth Committee member, Member of MobiSys 2021 TPC, and reviewer for many flagship journals and conferences such as ACM IMWUT, TMC, and CHI. She has won the ACM SIGBED China Doctoral Dissertation Award, Distinguished Paper Award for ACM UbiComp, the First Prize of Science and Technology in Shaanxi Higher Education Institutions, and the N2Women MobiSys 2018 Fellowship.

Dr. Rui Sun is currently an associate professor in the department of air transport, college of civil aviation, Nanjing University of Aeronautics and Astronautics, China. She is an PhD supervisor and Fellow of Royal Institute of Navigation (FRIN). Dr Rui Sun's research focus is on positioning and navigation for mission critical applications in challenging environments. She has been either the Principal Investigator (PI) or Co-Investigator (Co-I) for more than 20 national and international projects. She has published 2 books, more than 50 peer-reviewed papers in high quality journals, including the IEEE Trans Series etc. She has been awarded 12 patents and 4 provincial level technology progress awards. She was appointed to the 'outstanding young scholar fund of Jiangsu Province', 'Six Peak Talents Scheme' and received the 'Innovative and Entrepreneurial PhD Talent' award in Jiangsu Province, China. She is also an Editorial Board Member (EBA) of several journals, including the Journal of Navigation (JoN), Satellite Navigation, Journal of Navigation and Positioning etc.

Zhan Shi, Ph.D., Associate Professor, School of Computer Engineering, Nanjing Institute of Technology. His research interests mainly include artificial intelligence, machine learning and software engineering. He has been engaged in teaching and research work in computer science and technology, and data science and big data technology for a long time. He presided over or participated in the completion of a number of basic research and key engineering application projects such as the National Natural Science Foundation of China, the Natural Science Foundation of Jiangsu Province, and the High-tech Project of Jiangsu Province. He has published more than ten papers indexed by SCI or EI, and participated in the preparation of three industry standards. He is a member of IEEE and IEICE.

Details of Session

UAV swarm is a hot spot in the development of UAV system, in which robust and reliable cluster internal communication is the premise and guarantee to realize UAV swarm behavior. UAV has the characteristics of high-speed movement, which will lead to frequent changes in the topology of multi UAV system, and the communication links between UAVs are often broken, which brings unprecedented challenges to the establishment of communication links with low delay, high

throughput and low energy consumption. At present, the effective communication between multiple UAVs usually uses flight ad hoc network. However, due to the shortage of communication resources and the frequent changes of topology and easy fracture of links caused by the high-speed movement of UAV, the flight ad hoc network is difficult to meet the communication requirements of complex tasks, so its effectiveness, reliability and security need to be studied. On the other hand, in the confrontation environment such as incomplete information, uncertain environment and high dynamic adjustment, higher requirements are put forward for cluster task planning. Therefore, the autonomy, coordination and intelligence level of the system need to be optimized and improved.In view of the above problems, this topic takes the UAV cluster networking communication problem and task planning as the research object, focuses on the UAV network technology represented by self-organizing mesh network and the task planning method for cluster system, exchanges and discusses the problems in UAV cluster cooperative communication, and looks forward to the next research direction.

The invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following selected topics of “UAV Swarm Network and Task Coordination Cluster System”.

- UAV cluster cooperative communication technology
- UAV cluster networking technology
- Architecture design of intelligent task planning system
- Task planning method for cluster system
- Intelligent task planning model and algorithm
- Intelligent planning method of UAV mission and track