A Full-Day Pre-Conference Workshop for 2012 American Control Conference (ACC 2012)

June 26, 2012, Montreal, QC, Canada

Location: Fairmont Queen Elizabeth in Montréal

Health Management, Fault-tolerant Control, and Cooperative Control of Unmanned Aircraft

Presenters: Youmin Zhang* (Concordia University, ymzhang@encs.concordia.ca), Camille Alain Rabbath (Defence R&D Canada, Camille-Alain.Rabbath@drdc-rddc.gc.ca), YangQuan Chen (Utah State University, yqchen@ece.usu.edu), Christopher Edwards (University of Leicester, chris.edwards@le.ac.uk), Cameron Fulford (Quanser Inc., cameron.fulford@quanser.com), Hugh H.-T. Liu (University of Toronto, liu@utias.utoronto.ca), Liang Tang (Impact Technologies, LLC, Liang.Tang@impact-tek.com), Didier Theilliol (Nancy Universite, didier.theilliol@cran.uhp-nancy.fr), Antonios Tsourdos (Cranfield University, A.Tsourdos@cranfield.ac.uk)

Unmanned systems including Unmanned Aerial Vehicles/Systems (UAVs or UAS), Unmanned Ground Vehicles (UGVs), and Unmanned Underwater Vehicles (UUVs) etc are gaining more and more attention during the last a few years due to their important contributions and cost-effective applications in several tasks such as monitoring, surveillance, search, rescue missions, as well as military and security applications. Health management and fault-tolerant control of manned aerial vehicles have a long history since the initial research on self-repairing flight control systems in US Air Force and NASA begun in mid-1980s. However, due to the safety consideration of manned aircraft to the pilot, experimental test and further practical research and development have been limited due to such constraints. Benefited from the recent significant advances and development of UAVs, development and application of fault-tolerant control as well as cooperative control techniques with small/miniature UAVs have been emerged and developed quickly in recent years, since UAVs provide a cheap and operative experimental test-bed for development, implementation, and testing the latest developed health management, fault-tolerant, and cooperative guidance, navigation and control techniques. Based on the experiences gained by the 9 different participating organizations in this workshop, ranging from academic institutions, research organization, and industry of the leading groups in Canada, USA, France, and UK, the workshop will demonstrate the state-of-the-art techniques and development in health management, fault diagnosis, fault-tolerant guidance, navigation and control, safety and reliability, as well as multi-vehicle cooperative guidance, navigation and control techniques.

In this workshop, overview of past, current and future research activities and research outcomes on the health management, fault diagnosis, fault-tolerant control, and cooperative control applications with emphasis to UAVs will be presented, which include vehicles such as quadrotor rotary and fixed-wing UAVs. Linear and nonlinear techniques for modeling, fault diagnosis, fault-tolerant control, path and trajectory planning/re-planning, cooperative/formation flight guidance, navigation and control, based on a quadrotor helicopter UAV and several fixed-wing UAV testbeds will be presented in the workshop. Furthermore, health management, fault-tolerant control, and cooperative control strategies development with practical application scenarios on persistent surveillance and coverage control with multiple unmanned aircraft will be presented. Multiple UAS operations toward verifiable autonomy and assessment of the potential insertion of UAS in the air transportation system and safety aspects of UAVs will also be discussed.

Audience will gain information and knowledge on the latest development and applications on the active research topics in health management, fault detection and diagnosis, fault-tolerant control, and cooperative control of unmanned aerial vehicles from world-leading researchers. Audience will also have opportunity to visit a set of quadrotor helicopter UAVs at the Networked Autonomous Vehicles Lab (NAVL) of Concordia University for real flight demonstrations of fault-tolerant and cooperative control techniques presented in the workshop, in addition to the demonstrations and videos to be shown during the presentation of each presenter.

Graduate students, researchers, developers, managers and anyone who are interested in unmanned systems and techniques, with particular interests on health management, fault-tolerant control, and cooperative control of unmanned aircraft are encouraged for attending this useful and the state-of-the-art workshop.

Contact information of organizer:

Prof. Youmin Zhang, Ph.D., SM.AIAA, SM.IEEE, M.AUVSI/USC, M.CASI, M.CSME
Diagnosis, Flight Control and Simulation Lab (DFCSL)
Networked Autonomous Vehicles Lab (NAVL)
Department of Mechanical and Industrial Engineering
& Concordia Institute of Aerospace Design and Innovation (CIADI)
Concordia University
1515 St. Catherine West, EV12.103
Montreal, Quebec, Canada H3G 2W1
Tel: (514) 848-2424 ext. 5225; Fax: (514) 848-3175
Email: ymzhang@encs.concordia.ca
Web: http://users.encs.concordia.ca/~ymzhang/