



## **Opportunities, Challenges, Developments, and Applications of Unmanned Systems**

**Youmin Zhang**

Department of Mechanical & Industrial Engineering  
Concordia University  
1455 de Maisonneuve Blvd. W.  
Montreal, Quebec H3G 1M8, Canada  
youmin.zhang@concordia.ca

Unmanned systems including Unmanned Aerial Vehicles/Systems (UAVs or UASs), Unmanned/Autonomous Ground Vehicles (UGVs), and Unmanned Surface/Underwater Vehicles (USVs/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 surveillance, sense, search, rescue, autonomous transportations, military and security applications. What are the Opportunities, current Developments, and future Challenges towards practical Applications of these Unmanned Systems? In this talk, these issues and possible solutions will be reviewed in terms of important topics on challenging autonomous Guidance, Navigation and Control (GNC), fault-tolerant GNC for single UAV, and fault-tolerant cooperative GNC (FTC-GNC) for multiple UAVs and even multiple different types of unmanned vehicles including UAVs, UGVs, USVs, and UUVs. Relevant research and development works carried out at the Diagnosis, Flight Control and Simulation Lab (DFCSL) and Networked Autonomous Vehicles Lab (NAVL) of Concordia University will also be introduced in the talk.

Brief review on the development of autonomous unmanned aerial systems and challenges on autonomy and fault tolerance of unmanned systems will be given first, then the latest development and current research work in this active research and development area with applications to autonomous quadrotor helicopter UAVs and wheeled mobile robots/ground vehicles test-beds developed in collaboration with industry at the Diagnosis, Flight Control and Simulation Lab (DFCSL) and Networked Autonomous Vehicles Lab (NAVL) of Concordia University will be introduced.