Faculty of Engineering and Applied Science
Chemical Engineering Seminar Series

Swap Your Controller: Navigating Size, Weight, and Power Constraints for High Precision Aerial Autonomy

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Dupuis Hall, Room 217

Unmanned aerial vehicles (UAVs) serve diverse applications, from environmental monitoring and search and rescue to infrastructure inspection and logistics, providing flexible, real-time data collection across urban and remote areas. Yet, managing Size, Weight, and Power (SWaP) constraints is essential for achieving precision and reliable autonomy in small, resource-limited UAVs. This talk presents three SWaP-optimized controller designs. Addressing Size limitations, we develop and demonstrate a learning-based model predictive control tailored to a micro-UAV (<53 g), maximizing tracking accuracy despite limited onboard computational power. Addressing Weight constraints, we use lightweight onboard cameras in GPS-denied environments and develop a perception-aware controller to ensure robust localization. Addressing Power considerations, we explore coordinating UAVs to land on uncrewed surface vessels (USVs) for remote recharging in maritime applications. These designs leverage both prior and real-time data to enable sustainable, high-performance UAV operations for precision-demanding tasks in challenging environments.