Proceedings of the 11th International Conference of Control Dynamic Systems, and Robotics (CDSR 2024)
Chestnut Conference Centre - University of Toronto, Toronto, Canada – 10 -12 June, 2024
DOI: 10.11159/cdsr24.002

Aerial Manipulation: Perspectives and Challenges

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Unmanned aerial manipulation is an emerging area that combines the versatility and agility of unmanned aerial vehicles (UAVs) with the precision and dexterity of robotic arms for physical interactions with their environment. Unmanned aerial manipulators (UAMs) will meet the growing need for autonomous aerial manipulation in tasks that are costly, and/or hazardous, or even impossible for human operators. Examples of UAM applications include material handling, inspection and maintenance of infrastructure (e.g., power lines, and pipelines), emergency response, demining, and geophysical research in mineral exploration. Despite its substantial market and promises, UAM technology remains to be fully developed, limiting its current operation to simplified structured environments and, hence, leaving most of the related potential markets untapped.

In this talk, different assemblies, and configurations of UAMs, their advantages and applications will be presented. Additionally, remaining research challenges related to UAMs' operation in unstructured and challenging environments including those related to their control, planning, sensing, and teleoperation will be explored. The remaining part of the talk will be devoted to the new concept of aerial continuum manipulation (ACM) proposed in the speaker's group to overcome some of the challenges related to aerial physical interactions (APhIs) with the environment. The issues and some of the solutions related to modeling, perception and control within ACM realm will be presented.