A Modular Aerial Vehicle Combining Under and Fully Actuated Dynamic Behaviors

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Abstract:

This works presents the design of control algorithms for a class of modular aerial vehicles obtained by rigidly interconnecting a number of ducted-fan aircraft. Interestingly enough, it turns out that different formation topologies could lead to different dynamic properties of the interconnected system. Such a complex dynamic behavior is handled by means of suitable control allocation policies and by deriving a control structure able to switch according to the dynamical properties of the selected configuration. The resulting control strategy combines both classical under-actuated control schemes, employed in most Vertical Take-Off and Landing (VTOL) aerial systems, with fully-actuated feedback laws. The obtained modular paradigm can be employed in the design, modeling and control of different types of aerial configurations, including also multi-rotors.

In the final part of the talk, recent results regarding multi-robot systems achieving physical collaboration are also discussed and linked to the methodology developed for the modular aerial vehicle.

Discussion topics:

- The role of topology in modular aerial vehicles. Modular aerial vehicles can be considered as the interconnection of multiple actuator modules. For such a class of systems the interconnection topology determines the actuation properties of the overall system. Future research direction can focus on (optimally) exploiting the link between topology and the actuation properties for different classes of vehicles or even for multi-robot systems cooperating to achieve a certain task.
- Control allocation as a simple theoretical tool to establish how the topology affects the actuation properties of the overall interconnected system.