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Aerial Manipulation via Modular Quadrotors with Passively Foldable Airframes

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Abstract

The need for physical interactions and aerial manipulation has driven the demand for small multirotor vehicles with higher degrees of actuation and adaptability. This leads to the development of reconfigurable flying robots and modular flight platforms. In this work, we propose a modular vehicle comprising flight-capable quadrotors with passively deformable rotor arms as subunits. The foldable arms with preloaded elastic components are designed to be stable in both folded and unfolded states such that the reconfiguration can be achieved passively through the manipulation of the propelling thrust. A docking mechanism is devised to permit multiple modules to combine during a mission without human intervention. Through a series of experiments, we show that passive reconfigurability enables the platform to perform perching. With the added modularity, the integrated platform can be used to perform thrust vectoring or grip and transport heavier payloads. The ability to accomplish a wide range of tasks in a single platform is unique from existing aerial robots, thanks to the combination of reconfigurability and modularity.

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