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A fixed wing UAV with VTOL capabilities: design, control and energy management

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Published Online: December 5, 2022 • pp 206-221 • https://doi.org/10.1504/IJMIC.2022.127521

Abstract

There is an increasing interest for unmanned aerial vehicles (UAVs) with mixed, multi-rotor propulsion layouts able to assure desirable features of both fixed wing systems (efficiency high cruising speed autonomy) and capabilities of rotating wing ones (hovering, vertical take off and landing). In this work, it is investigated a mixed propulsion layout with five electric propellers fed by a hybrid energy management system able to assure an higher autonomy with respect to a pure electric solution. Proposed system is investigated through the development of a model able to properly simulate complex interactions arising between different propulsion, control and energy management subsystems. In this way it was possible to propose and calibrate an efficient energy management policy and to evaluate how different transition policies between hovering and fixed wing cruising should affect energy consumptions. Finally, proposed model was used to simulate a complex mission profile in order to verify both manoeuvring capabilities of the system and foreseen energy consumptions. At the end, it was possible to verify not only the feasibility of the proposed solution with respect to the completion of a complex mission profile but also potentialities and utility of adopted simulation models.

Keywords

unmanned aerial vehicles, UAVs, vertical take off and landing, VTOL, hybrid propulsion systems, control: simulation

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