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Additive Manufacturing in Unmanned Aerial Vehicles (UAVs): Challenges and PotentialG. D. Goh¹, S. Agarwala¹, G. L. Goh¹, V. Dikshit², W. Y. Yeong^{1,2*}

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Abstract

Unmanned aerial vehicles (UAV) are gaining popularity due to their application in military, private and public sector, especially being attractive for fields where human operator is not required. Light-weight UAVs are more desirable as they have better performance in terms of shorter take-off range and longer flight endurance. However, light weight structures with complex inner features are hard to fabricate using conventional manufacturing methods. The ability to print complex inner structures directly without the need of a mould gives additive manufacturing (AM) an edge over conventional manufacturing. Recent development in composite and multi-material printing opens up new possibilities of printing lightweight structures and novel platforms like flapping wings with ease. This paper explores the impact of additive manufacturing on aerodynamics, structures and materials used for UAVs. The review will discuss state-of-the-art AM technologies for UAVs through innovations in materials and structures and their advantages and limitations. The role of additive manufacturing to improve the performance of UAVs through smart material actuators and multi-functional structures will also be discussed.

Keywords: UAV, 3D printing, Rapid prototyping, Additive Manufacturing, Smart materials, Structures, Multi-functional.

1. Introduction

Evolution of unmanned aerial vehicles (UAVs) that started during World War II has come a long way for both military and non-military operations. UAVs are finding wide-spread use in fields where employing human operator is either cumbersome and unsafe, or not required altogether. Applications and mission of UAVs now range from agricultural surveillance [1], meteorological data acquisition [2] to disaster monitoring [3], with size varying from that of a small bird to helicopter. Recent trends and reports suggest that the number for UAVs will increase by few thousand for various

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