Active Wing Shaping Control Concept Using Composite Lattice-based Cellular Materials

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The proposed research presents a novel active wing morphing aerostructure concept by combining the advanced composite lattice-based cellular materials/components and the multi-objective optimal flight control design to realize continuous morphing wing control, so as to improve aerodynamic efficiency for future air vehicles. This concept leverages a building block strategy for lattice-based components, which provide great adaptability to varying flight scenarios, the needs that are essential for in-flight wing shaping control. Unlike conventional aircraft control actuation mechanisms, with rigid kinematic flaps and electric/hydraulic motor driven components, the proposed lattice-based cellular wing structure provides the necessary deformation compliance through the precise distribution and actuation of heterogeneous structural elements along span-wise and chord-wise directions to achieve a desired wing shape.