Abstract Submitted
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Flow control at low Reynolds numbers using periodic airfoil morphing[1] GARETH JONES, MATTHEW SANTER, GEORGE PAPADAKIS, Imperial College London, YANN BOUREMEL, MARCO DEBIASI, National University of Singapore, IMPERIAL-NUS JOINT PHD COLLABORATION — The performance of airfoils operating at low Reynolds numbers is known to suffer from flow separation even at low angles of attack as a result of their boundary layers remaining laminar. The lack of mixing — a characteristic of turbulent boundary layers — leaves laminar boundary layers with insufficient energy to overcome the adverse pressure gradient that occurs in the pressure recovery region. This study looks at periodic surface morphing as an active flow control technique for airfoils in such a flight regime. It was discovered that at sufficiently high frequencies an oscillating surface is capable of not only reducing the size of the separated region — and consequently significantly reducing drag whilst simultaneously increasing lift — but it is also capable of delaying stall and as a result increasing $C_{L_{max}}$. Furthermore, by bonding Macro Fiber Composite actuators (MFCs) to the underside of an airfoil skin and driving them with a sinusoidal frequency, it is shown that this control technique can be practically implemented in a lightweight, energy efficient way.

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