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Optimisation of a novel trailing edge concept for a high lift device

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Abstract

This research aims to improve aerodynamic performance of a high lift system by means of implementing a novel concept (referred to as the flap extension) on the leading edge of the flap of a three element high lift device. The concept is optimised using two optimisation approaches based on Genetic Algorithm optimisations. A zero order approach which makes simplifying assumptions to achieve an optimised solution: and a direct approach which employs an optimisation in ANSYS DesignXplorer using RANS calculations. The concept was seen to increase lift locally at the flap. The solution to the zero order optimisation showed a decreased stall angle and decreased maximum lift coefficient due to early stall onset at the flap. The DesignXplorer optimised solution matched that of the baseline solution very closely. Computational Aeroacoustic simulations were performed using the DES model in 2D on the baseline and DesignXplorer optimised solution. The DesignXplorer optimised concept steadied the shear layer that bounds the spoiler cove thus reducing noise from this vicinity by 10dB at frequencies over 7 000Hz.