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Separation Control by Stationary and Time Periodic Lorentz Forces

Tom Weier, Gunter Gerbeth, Gerd Mutschke

Forschungszentrum Rossendorf, Dresden, Germany

Stationary and time periodic wall parallel Lorentz forces in streamwise direction have been used to control the suction side flow of NACA 0015 and PTL IV hydrofoils. Experimental results, consisting of flow visualizations and force measurements in the low Reynolds number range $Re = 0.5 \ldots 1.5 \times 10^5$ will be presented. A stationary Lorentz force may increase lift by two mechanisms: 1) reattaching the separated flow and therefore increasing the critical angle and 2) introducing circulation due to acceleration of the attached suction side flow. Periodic excitation by oscillatory Lorentz forces near the leading edge is able to reattach the separated flow with much less momentum input then required for stationary forcing. However, to increase the maximum lift gain requires a comparable expenditure for both methods. The action of a wall parallel Lorentz force compares well to that of momentum input by blowing.

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