Application of wavy surface for flow separation elimination on swept wing at low Reynolds number.

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The present work is devoted to investigation of incompressible flow feature at near stall angle of attack on classical and wavy surface wing with aspect ratio $\lambda = 3.7$ at Reynolds number $1.5 \cdot 10^5$[1]. Such kinds of the wings at the same Reynolds number are employing on micro air vehicle. Vitality of the small aircraft at near ground atmospheric condition flight depends from predictable wing behavior at near stall angle of attack. Separation and attached flow structure at lee surface of wavy and classical wing was shown by oil-film visualization at sweep and no sweep angle condition. It was shown the wavy wing at no sweep condition has the stall angle of attack lager than classical one. At post-stall angle of attack $\alpha = 9^o$ for classical wing sweep angle increasing from 15^o to 45^o results to changing from separation flow regime to attached one. On wavy wing at the same angle of attack and sweep angle from 0^o to 45^o the attached flow is observed only. In practice, this means that micro air vehicle will easy controlling by automatic system and will fall in stall regime rarely as well as wind power machine efficiency increasing.

Keywords: low Reynolds number, swept wing streamlining, wavy surface, boundary layer, separation bubble, laminarturbulent transition, oil-film visualization.

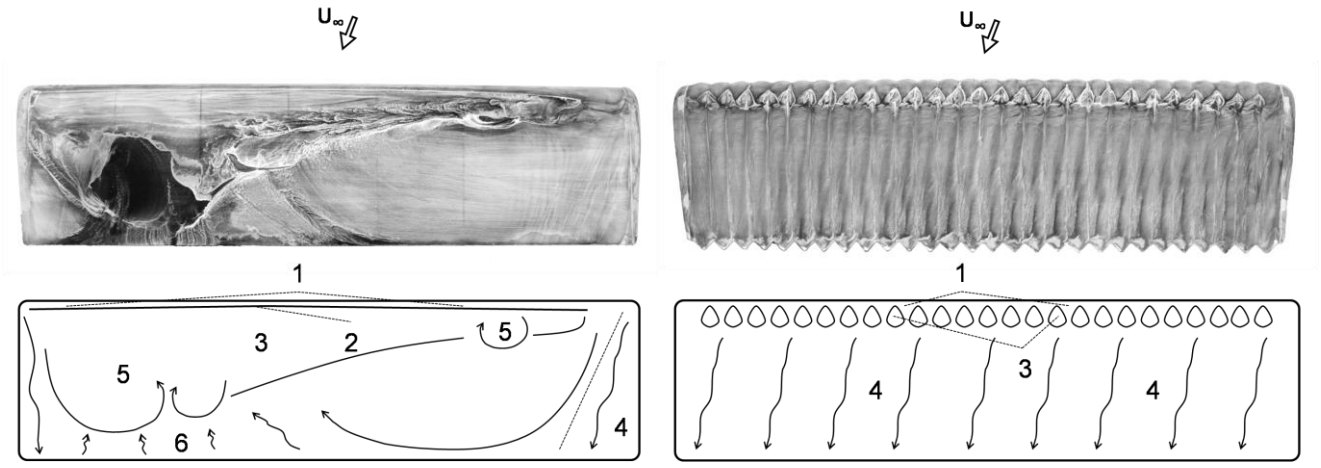

Figure 1. Flow separation on flat and wavy wing surface with similar profile: $Re=1.5\times10^5$, free stream turbulence level ε =0.04%, angle of attack $\alpha=9^o$, angle of sweep $\beta=15^o$. 1– laminar boundary layer; 2 – line of separate laminar boundary layer; 3 – separation bubbles; 4 – reattached turbulent boundary layer; 5 – large scale vortexes structures; 6 – reverse flow.

1 I. D. Zverkov, V. V. Kozlov, A. V. Kryukov. Flow feature near unswept and swept finit span wing with smooth and wavy surface at stall angle of attack// Vestnik NSU Vol.7. No.4. P59-67(Russian).