Labor Windkanal/Strömungsmesstechnik

OSTBAYERISCHE TECHNISCHE HOCHSCHULE REGENSBURG

Potential of aerodynamic performance gain by taking influence of the boundary layer on a flap wing

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1. Outline

This bachelor thesis deals with the aerodynamic optimization of the wing profile SL13-260 by taking influence to the boundary layer with transition stripes. The process of natural transfer of the boundary layer from laminar to turbulent can occurs detach bubbles and streaming detachments, witch decreases the aerodynamic quality of the wing. By using transition stripes the boundary layer becomes forced transshipped whereby the streaming gets more kinetical energy to follow the geometric profile course. The objective is to reduce the drag coefficient of the wing profile.

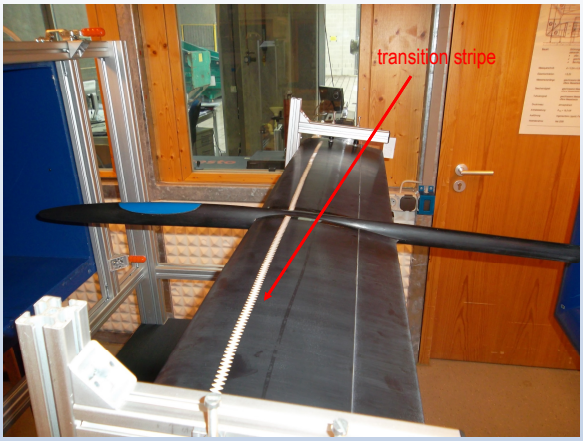

Fig. 1: Test rig in the Regensburger Windtunnel with the Planemodel

2. Various flap wing angle position

Furthermore various flap wing angle positions has been installed and defined at the sailplane model for different flying states like slow fly, gliding fly and standard fly to optimize the performance of flying for the respective streaming situation. To steering and control the flap wings, two electric motors with a microcontroller inside the planemodel.

Fig. 2: microcontroller chip inside the modelbody under the cockpit

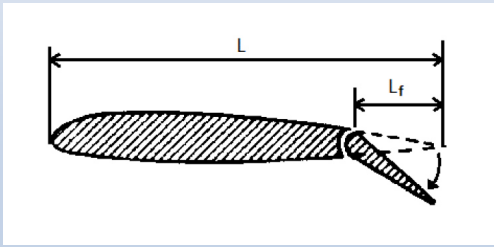

Fig. 3: sketch of wing profile with angled flap wing

3. Simulations with X-FOIL

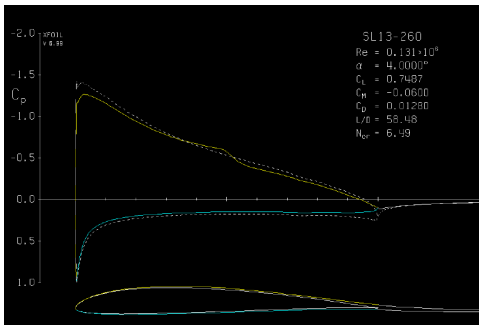

Fig. 4: simulation results with pressure, drag and lift coefficient at an 4° attack angle

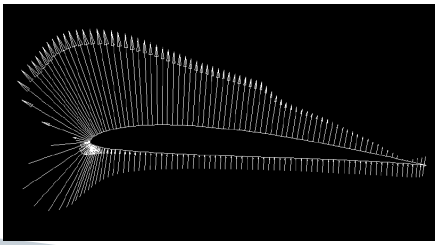

Fig. 5: representation of pressure vektors on the wing profil

With the simulation tool X-Foil for boundary simulations the approximately position of the transition stripes has been detected and localized, as well as the theoretical potential of performance increasing. Various stripes with different roughness has been tested and compared.

4. Measurements, results

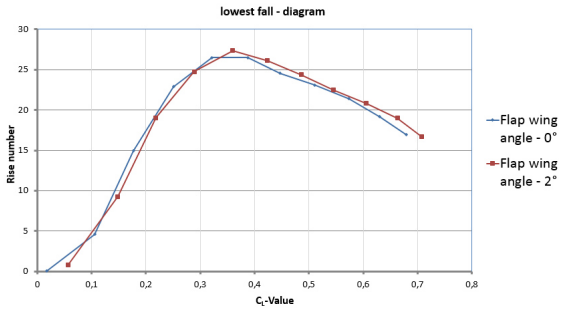

Fig. 6: comparison of two measure lines with different flap wing angles

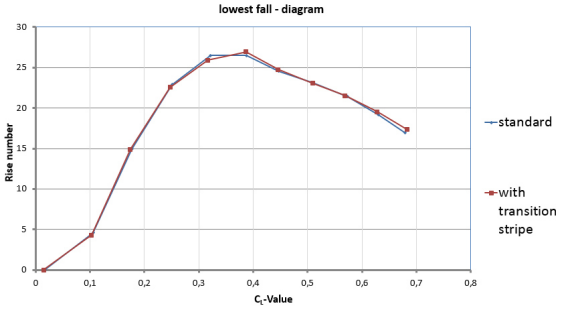

Fig. 7: comparison of two measure lines with and without transition stripe