Labor Windkanal/Strömungsmesstechnik

OSTBAYERISCHE TECHNISCHE HOCHSCHULE REGENSBURG

Improvement of Lilienthal profile measurement regarding measurement performance

Verbesserung der Lilienthal-Profilmessung hinsichtlich der Messgüte (VeLiProM)

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1. Project target

Inside the closed test section of the wind tunnel in Regensburg drag and lift of different airfoils can be measured. The drag- und lift-coefficients are calculated fully automated and merged into Lilienthal polare curves.

For further optimization different workpackages were defined:

- Porting of the measurement software on a portable workstation located next to the test section.
- Building of a new wake rake adjusting mechanism
- 2D- and 3D-simulations
- Model wing with deflectable trailing edge flap

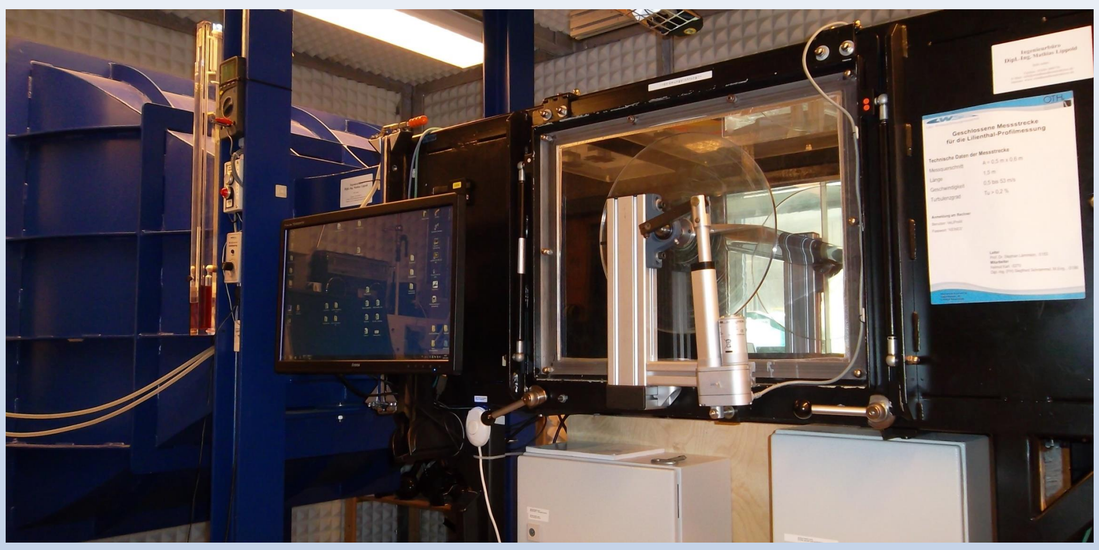


Fig. 1: Improved test section

2. Simulations (Ansys CFX and XFOIL)

For a better understanding of air flow phenomena inside the closed test section 3D-CFD-simulations with ANSYS CFX have been performed. To validate the measurements in the test section the results have been compared with 2D-simulations with XFOIL.

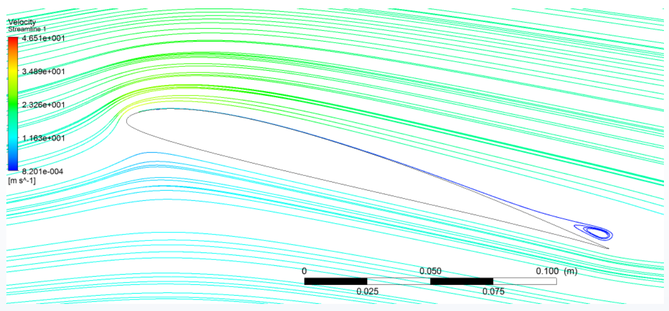


Fig. 2: 3D-streamlines in ANSYS CFX

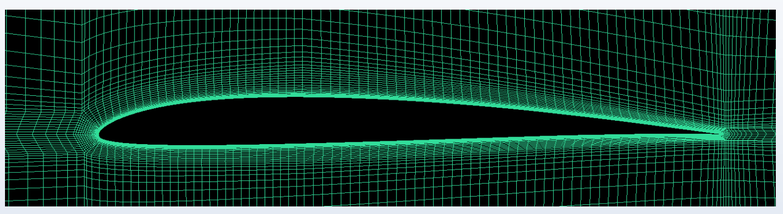
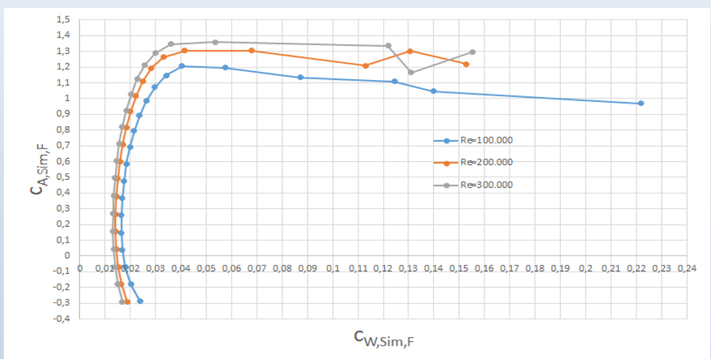


Fig. 3: 3D-airfoil mesh in ICEM CFD

Fig. 4: Polar curve with different Re-numbers calculated with ANSYS CFX



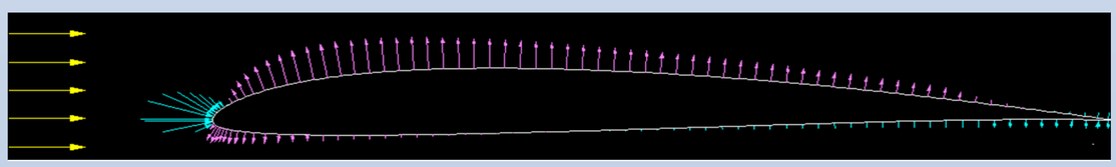


Fig. 5: c_P -distribution on the airfoil surface with XFOIL

3. New wake rake adjusting mechanism

To improve measurement performance a new wake rake adjusting mechanism has been designed, manufactured and mounted. Basic aims were to improve stiffness and weight and to get a smaller, more aerodynamic silhouette and higher accuracy.

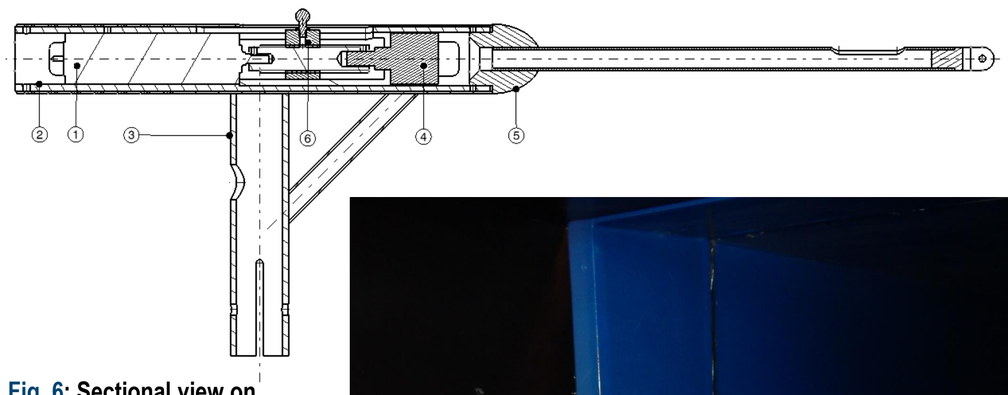


Fig. 6: Sectional view on the adjusting mechanism

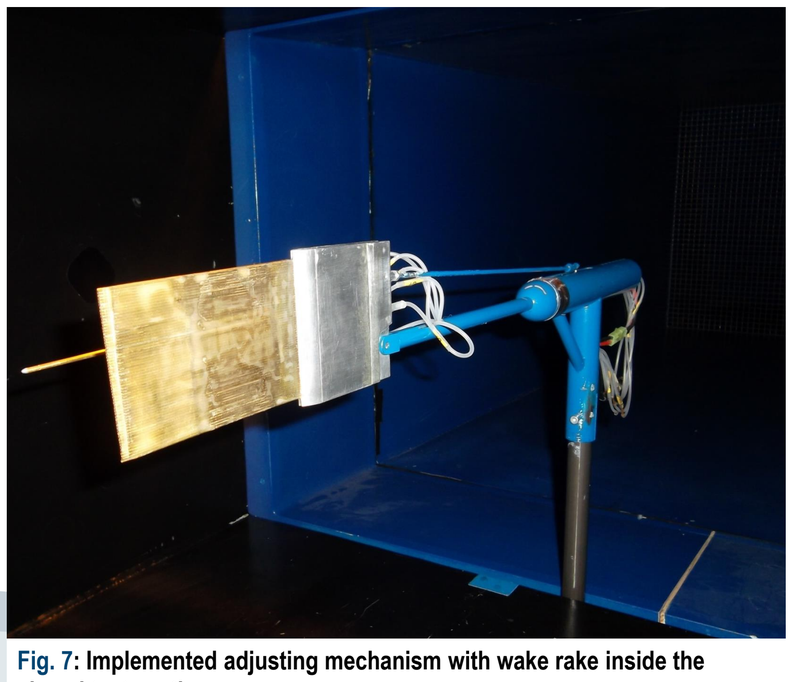


Fig. 7: Implemented adjusting mechanism with wake rake inside the closed test section

4. Model wing with deflectable trailing edge flap

To investigate the influence of a moveable trailing edge flap a carbon fiber reinforced plastic wing has been designed and manufactured. The flap can be adjusted via a Rotary Drive System which can be controlled from outside.

Fig. 8: Wing made of carbon fiber reinforced plastic

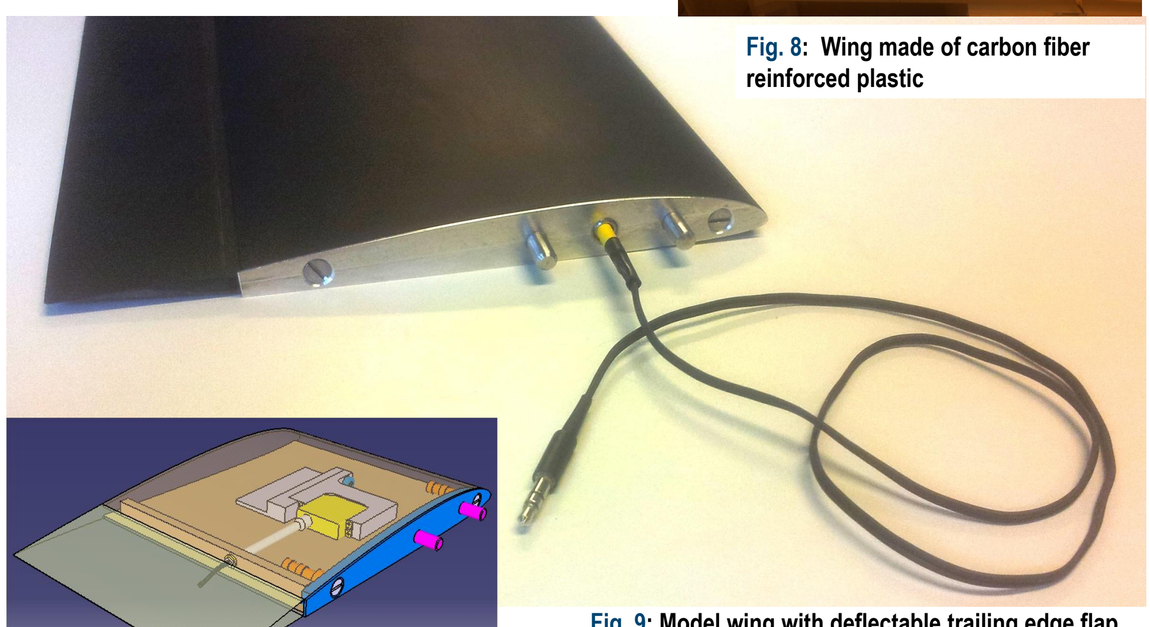


Fig. 9: Model wing with deflectable trailing edge flap and control wire

Fig. 10: Rotary Drive System inside