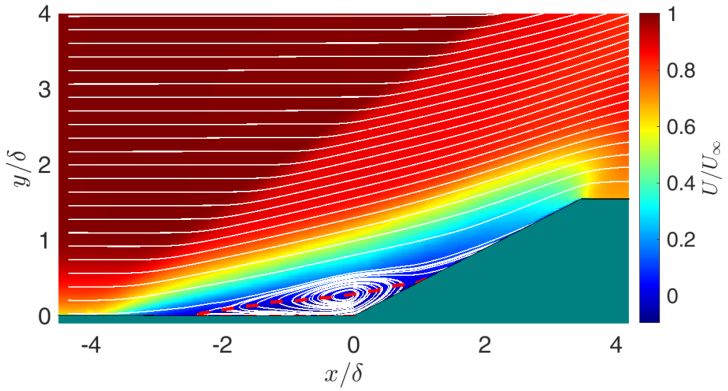
RWTH AACHEN UNIVERSITY

Institute of Aerodynamics and Chair of Fluid Mechanics

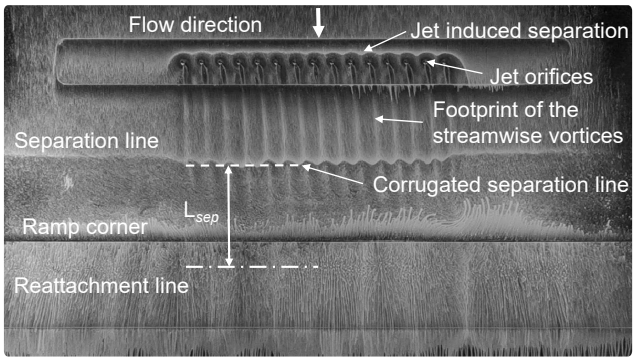
## Bachelorarbeit / Masterarbeiten

# Separation control with air-jet vortex generators in a shock-wave/turbulent-boundary-layer interaction

Flow field around high speed vehicles are characterised by frequent occurrence of shock-wave/boundary-layer interactions. A strong shock-wave imposes a large adverse pressure gradient on the boundary layer and can induce large scale separation. This interaction can lead to high local fluctuating pressure and thermal loads detrimental to the vehicle structure. Hence, effective control of these phenomena is necessary for cheaper and more efficient air and space transportation. A promising approach is based on the injection of air-jets into the boundary layer. The streamwise vortices generated by these air-jets redistribute the momentum within the boundary layer, making it more resistant to separation. The effectiveness of air-jet vortex generators in mitigating flow separation has been verified in subsonic, transonic and supersonic flow conditions. However, further studies are essential to understand the underlying governing mechanism. In the framework of this proposed thesis, state-of-the-art experimental techniques will be used to study the influence of air-jet vortex generators on shock wave / turbulent boundary layer interactions. This project is embedded in the Emmy Noether Program of the German Research Foundation, details of which can be found in `http://gepris.dfg.de/gepris/projekt/326485414`.




(a) Mean streamwise velocity ($U/U_\infty$) of the baseline case from PIV showing the massive separation region




(b) Oil-flow visualisation showing the effect of air-jet injection on the flow.

## Requirements

- Good Knowledge of Fluid Mechanics (Compressible flows is an added plus).
- Experience with CAD designing (Catia/Inventor) (bonus).
- Knowledge of Matlab (preferable).
- Affinity for performing practical work.
- Preference to write the Master thesis report in English.
- Enthusiasm to work in a project that would one day pave the way for efficient high speed flight.

## Tasks

- A brief literature survey on separation control in high speed flows.
- Active participation in the experimental campaign.
- Analysis and post-processing of the obtained data.
- Discussion of the results and comparison with literature.
- Submission of final thesis report.

## Contact:

If you have any questions / are interested and would like to know more about the project, feel free to send an email with your CV or pass by our office.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