Calibration of aerodynamic probes: Improvement of data reduction algorithms and use of Gaussian process

An aerodynamic probe has to be calibrated before using it in an unknown flow field. In a free-jet facility combinations of velocities and angles are set. The measurand (e.g. voltage or pressure) are recorded with the probe. At the Chair of Aerodynamics and Fluid Mechanics hot-wire probes (constant current anemometry) and pressure probes are used in wind tunnel experiments. There are reduction algorithms which post-process the measures data in order to finally get the flow parameters of interest. These post-processing codes often rely on interpolation schemes. The main goal of this thesis is the improvement of the code itself and its usability. Possible work packages include the optimization of the Matlab (pressure probe) and Fortran (hot-wire) codes, migration in different programming languages, a performance enhancement or the development of a graphical user interface. Furthermore, the usage of neural networks instead of interpolation methods have to be assessed. Last, with the usage of a Gaussian process, we think that the calibration effort could be reduced dramatically. First results show promising results. Further tests and implementation are needed. The gathering of test data is part of this last work package.
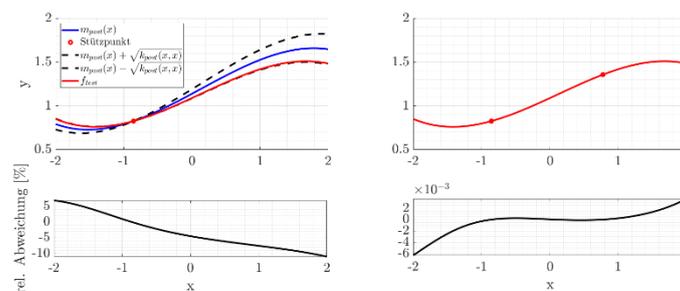

Figure 1: Example for an a posteriori Gaussian Process

Preliminary work packages:

1. Familiarization with working principles of (multi-hole) probes and hot-wire measurements
2. Familiarization with existing codes (Matlab/Fortran)
3. Migration to newer/more performant programming languages
4. Optimization of data reduction codes
5. Development of GUI
6. Gaussian processes: Data gathering and implementation in code

If you are interested in this topic or you have questions, feel free to contact me.

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