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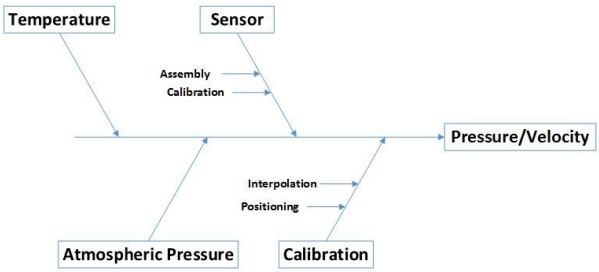
Uncertainty in Measurements: Evaluation of Uncertainty and Errors in Multi-Hole Pressure Probe Measurements with Probabilistic Programming Languages (PPL)

Every measurement is subject to certain uncertainties. Depending on the measuring instruments and processes in use, small uncertainties, e.g. when calibrating the multi-hole probe, can affect the actual measured results severely. There are various methods for determining the uncertainties of the individual components. In the thesis, all components that can contribute to the measurement uncertainty should be identified and evaluated. This model should be modular in order to allow further extensions. First, the individual components (e.g., sensors, calibration) should be evaluated separately and then in the next step be linked in an overall model of the multi-hole probe. The propagation of small uncertainties in an early step could lead to not negligible uncertainties within the post-processed data. Probabilistic programming languages simplify the statistical modelling and handling of measured data (sampling and conditioning). This data can be used for the inference step (Bayesian Inference):

$$p(x|y) = \frac{p(y|x)p(x)}{p(y)}$$



Preliminary work packages:

1. Familiarization with working principles of multi-hole probes and uncertainty evaluation
2. Identification of PPL (e.g. Pyro/PyTorch)
3. Development of a model for the estimation of uncertainties and errors for the unsteady probe
4. Evaluation and generation of measured data

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

Florian Heckmeier
Wissenschaftlicher Mitarbeiter, PhD Candidate

Lehrstuhl für Aerodynamik und Strömungsmechanik
Technische Universität München
Boltzmannstr. 15
D-85748 Garching bei München
Germany
Tel.: +49 (0)89 289 16723
Mailto: florian.heckmeier@aer.mw.tum.de
Homepage: Florian Heckmeier