The NACA 63(3)-018 benchmark

An update

On behalf of:

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Two main purposes:

HAWT workshop:
To advance the understanding, use and utility of hybrid test sections and to enable cross-facility comparisons through verified benchmark cases.

IEA Wind TCP Task 39 *Serration noise benchmark*:
A unified validation data set comprising all verified data including the effect of serrations and including uncertainty estimates.

The NACA 63(3)-018 benchmark

Background

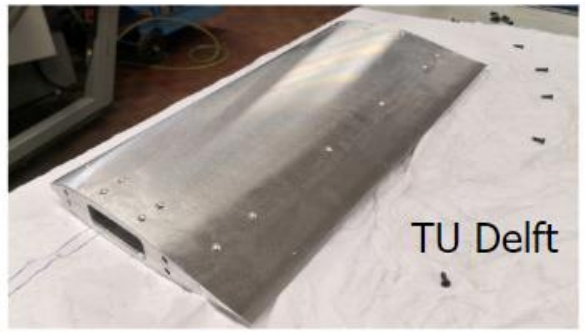
High Reynolds number model

chord = 0.9 m, Re_c up to ~$4 \cdot 10^6$

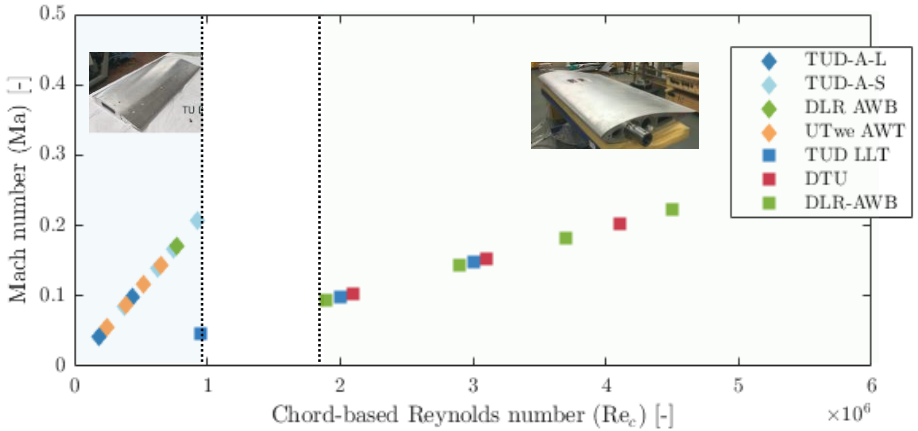
Who	Facility	Test Section Type
Virginia Tech	Stability Tunnel	Hybrid
DTU	Poul la Cour	Hybrid
TU Delft	LTT	Hybrid/closed
DLR/DNW	NWB	Closed/open-jet

Low Reynolds number model

chord = 0.2 m, Re_c up to ~$0.9 \cdot 10^6$



Who	Facility	Test Section Type
TU Delft	A-Tunnel	Open-jet
DLR	AWB	Open-jet
UT	AWT	Open-jet (hybrid and closed)



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Preceding outputs

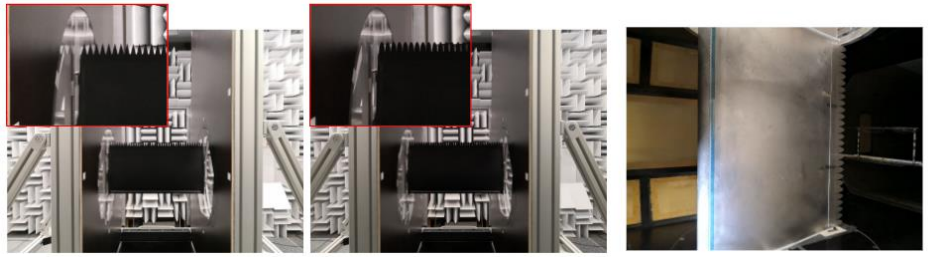
2020 HAWT Workshop

- Comparative testing of a NACA 63(3)-018 airfoil model (**HRM** model) 0.9m.
  http://dx.doi.org/10.1088/1742-6596/2265/2/022103

- NACA 63(3)-018 with trailing-edge serrations: **benchmark introduced.**

2021 HAWT Workshop

- Aeroacoustic characterization of a NACA 63(3)-018 airfoil with trailing-edge serrations: a benchmarking study across facilities over a wide Reynolds number range -> **initial benchmark results.**



2021 IEA Task 39 report

- Technical report - Serration noise benchmark.
  https://iea-wind.org/task39/t39-publications/

2022 HAWT Workshop

- First **publication of benchmark results**
  Including **subset of the** aerodynamic and aeroacoustic **data** of both the **LRM** and **HRM.**
  https://doi.org/10.2514/6.2022-2981

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Active progress

- **TU Delft:** Comparison of the A-Tunnel (open-jet) and LLT (hybrid) measurements

- **DTU & DLR/DNW:** Comparison of the PLCT (hybrid) and NWB (closed/open-jet) measurements

- **UT** has joined the NACA 63(3)-018 benchmark team in-kind (April 2023)
  - > **Early-stage PhD candidate**: Ka Kin Tou
    - Supervision: M.P.J. Sanders
    - Started in Dec. 2022
  - > All available data is currently being re-organized and structured.
    - This should include all RAW data.

We invite **Virginia Tech** to participate in the current collaboration including the serration benchmark.

  - > A standard processing framework is being set up for systematic comparison.

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Targeted outputs (in systematic order)

i. Cross validation of the aerodynamic and acoustic measurements of the HRM model in two Kevlar-walled wind tunnels. (10.1088/1742-6596/2265/2/022103)
   - HRM model
   - VT and DTU
   - First comparison is completed but more work is to be done.

ii. Cross comparison of the aerodynamic and acoustic measurements of the HRM model in different wind tunnel facilities. **This work package is yet to be defined.**
   - VT, DTU, DLR/DNW (NWB) and TUD (LTT)

iii. Cross comparison of the aerodynamic and acoustic measurements of the HRM and LRM model. (https://doi.org/10.2514/1.J061630)
   - TUD (LTT and A-Tunnel)
   - First comparison is completed but additional work is being done to improve the LTT facility.

iv. Cross comparison of the aerodynamic and acoustic measurements of the LRM model.
   - TUD (A-Tunnel), DLR (AWB) and UT.

v. A unified and publicly available data set comprising verified data including uncertainty estimates. The data should set a standard for model evaluation.