

MODEL DEFORMATION MEASUREMENTS (MDM) IN S2MA

MDM objectives at up to transonic speeds

MDM measurements determine the exact shape of a model when experiencing aerodynamic loads, from these measurements are derived corrected aerodynamic coefficients (drag, lift, pitching moment) as compared to a reference shape (“rigid body”). The knowledge of the actual model shape is especially critical for CFD validation, but also for aileron effectiveness for example.

MDM application

MDM system is an in-house application based on the calculation of passive markers positions through photogrammetry.

The markers are glued on the model and observed through two CCD cameras of high resolution (4872x3248 pixels or 2672x4008).

MDM measurements are available on both full-span models and half-models, over the entire operating domain of the wind tunnel.

Preparation

There is no specific requirement concerning the model preparation. The markers, provided by Onera, are stuck on the model during the test preparation phase.

Usually on full-span models, only the lower side of one wing is equipped (typically 40 markers).

The camera installation is done in parallel with other preparation tasks.

The camera adjustment and calibration need 2 hours inside the test section, wind off, +1 hour per calibration analysis.

Testing

MDM measurements are performed at the same time as classical measurements (forces, pressures, etc.) during pitch or yaw sweeps.

Extra costs: no need for extra runs; only 1 person more to operate the MDM system. No effect of the markers on aerodynamic characteristics.

Results

MDM system fully integrated within the WT measurement system.

MDM measurements are synchronized with classical measurements, and are available at a frequency of 2Hz.

MDM results are available at the end of each run.

Accuracy

Repeatability

- twist: +/- 0.03° (+/-0.05° for yaw sweeps)
- bending: +/- 0.5 mm

Extra cost to the customer

Preparation: 23 k€ per calibration (3h of occupancy included)

Test performance: 1 k€ per day