

Great recirculation wind tunnel

SZ.1.1. Shear layer control; investigation on the interaction of driver cabin, spoilers, guiding elements, and charge cabin; using a segmented truck model

In the case of segmented vehicles, the fluid mechanical interaction between the vehicle parts (driver cabin, charge cabin) is of practical importance from the viewpoint of aerodynamic drag (and thus, fuel consumption).

Assignment: experimental investigation and understanding of such interaction.

In the 45 min of the measurement, the following activities are to be carried out:

- a) Calibration of the balance (in 2-3 points, using weights),
- b) Investigation of 4-6 varieties of spoilers and guiding elements, at flow incidence parallel to the longitudinal axis:
- c) By visualization using oil smoke and taking photographs,
- d) By force measurements,
- e) By static pressure measurements.

Availabilities:

- Approx. 1:10 scaled-down truck model with pressure taps; various spoilers and guiding elements to be fixed to the model,
- Balance located in the wind tunnel measurement section, capable for measurement of longitudinal force,
- Pitot-static probe for wind velocity measurements,
- Oil smoke generator,
- Pipe and probe for introduction of the oil smoke,
- Manometer.

A camera is to be provided by the measurement group. Possibility is given for testing customized driver cabins and flow guides prepared by the measurement group.

Background information (chapters from Lajos, T.: Fundamentals of Fluid Mechanics, 2004, 3rd Edition):

2.1.1. Pathline, streakline, streamline, 2.1.3. Flow visualization, 3.3.3. Static, dynamic, total pressure, 3.4.1. Euler component equations in the natural coordinate system, 3.4.2. Applications, 6.2.4. Instruments based on the deformation of a flexible body, 6.2.5. Practical pressure measurement problems, 6.3.1. Determination of velocity based on the measurement of dynamic pressure, 8.5.2. Preconditions for similarity of flows, 9.1.1. Characteristics of boundary layers, 9.2.2. Development of the boundary layer in streamwise direction, 9.3.1. Development of shear stresses in the boundary layer, 9.3.2. Boundary layer separation, 9.3.3. Flow past a cylinder, 9.3.5. Control and elimination of boundary layer separation, 10.1.2. Dimensional analysis, 10.1.3. Application of dimensional analysis, 11.1.1. Development of aerodynamic forces, 11.1.2. Aerodynamic force acting on a cylinder, 11.2.2. Aerodynamic force acting on bluff bodies. **Further recommendations: From 4th Edition:** 6.4.1. The aim of application of wind tunnels, 6.4.2. Types of wind tunnels, considering velocity and layout, 6.4.3. Structural elements of wind tunnels, layouts for measurement sections, 6.4.4. Practice of wind tunnel measurements, and/or Bradshaw, P., Mehta, R.: Wind tunnel design www-htgl.stanford.edu/bradshaw/tunnel/

Further information –

Vehicle model measurements:

CD appendix for 3rd edition: M.11.2.4. Vehicle aerodynamics PP presentation (in 4th edition: DVD appendix, M.11.3.1 presentation). From 4th edition: 11.3.1. Aims and approximations of vehicle aerodynamics, 11.3.2. Classification of flow domain past car bodies, the front surface drag and its moderation, 11.3.3. Rear surface, under-chassis and sidewall drag, 11.3.4. Flow past buses and trucks