Trolley 2

K.2.2. Measurement of pressure distribution and pressure difference fluctuation (drag and transversal force) on a square-based cylinder

The knowledge on characteristics of flow past square-based cylinders is of importance in many practical applications. At low Reynolds numbers, Von Karman vortex street develops past the cylinders.

Assignment: determination of difference between the local pressure and that in the channel, as well as its fluctuation (amplitude and frequency), along the periphery of a square-based cylinder, by rotating the cylinder; study on the effect of downstream plates of various sizes, aligned parallel to the incoming flow ("splitter plates") on the distribution of pressure and its fluctuation.

In the 45 min of the measurement, the following activities are to be carried out:
   a) In the channel of square cross-section, at a given velocity, measurement of pressure (with reference to the pressure in the channel) and its temporal fluctuation, by rotating the cylinder
   b) Study a) at 2 further velocities
   c) Study a) at a given velocity, with application of 2 splitter plates of various size.

Availabilities:
   - Channel of square cross-section, with possibility of adjustment of flow velocity
   - Square-based cylinder, rotatable about its axis, with 4 pressure taps on one side, with pressure sensor capable for measurement of fluctuating pressure, with PC for data acquisition
   - Software for processing and evaluation of results
   - 2 splitter plates of various size
   - Pitot-static probe for velocity measurements,
   - Manometer.

Expected 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/

Expected further background information –
For measurements SZ2.1, K3., K4: from 4ᵗʰ Edition: 11.1.2. Aerodynamic force acting on a cylinder, 11.1.3. Aerodynamic force acting on non-circular cylinders, stripes, spheres