

Building Aerodynamics

Topics for the final exam

1. Characteristics of atmospheric boundary layer. Logarithmic and power-law approach of boundary layer wind profile. Roughness length, displacement height. Surface categories. Wind velocity distribution over hilltops. Vertical profile of turbulence intensity in the boundary layer.
2. Bluff body aerodynamics: comparison of flow around bluff and streamlined bodies in a real (viscid) fluid. Expression of wind force acting on a solid body by friction and pressure coefficient. Order of magnitude of friction and pressure coefficients.
3. Boundary layers: laminar and turbulent. Boundary layer separation, conditions, examples, control. Consequences of flow separation on pressure distribution over building surfaces. Magnitude of pressure and velocity inside separation bubbles.
4. Wind tunnel methods in building aerodynamics: main parts of boundary layer wind tunnels, methods of generating an atmospheric-like boundary layer. Determination of wind loading on scaled models with multi-channel pressure measurements.
5. Flow around a simple rectangular block building (sharp edged cube): flow structures, surface regions, approximate pressure coefficient values, and other flow features (shear layers, vortices, separation bubbles etc.) Regions with peak wind loading on the roof. Flow field and pressure distribution at 45° angle flow around the cube.
6. Wind loading on telecommunication towers: parts of the tower on which wind load is acting, measurement results for the drag acting on parts of circular cross-sections, critical Re number according EUROCODE and wind tunnel measurements, (diagrams). Angle of separation, pressure coefficient in separation bubble at sub and supercritical flows. Practical consequences for the payload of towers.

Literature:

- Lajos Tamás: Az áramlástan alapjai
- Building aerodynamics lectures:
<http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW08/2012-2013-I/lecture/>
- Password to protected files: guestlecture