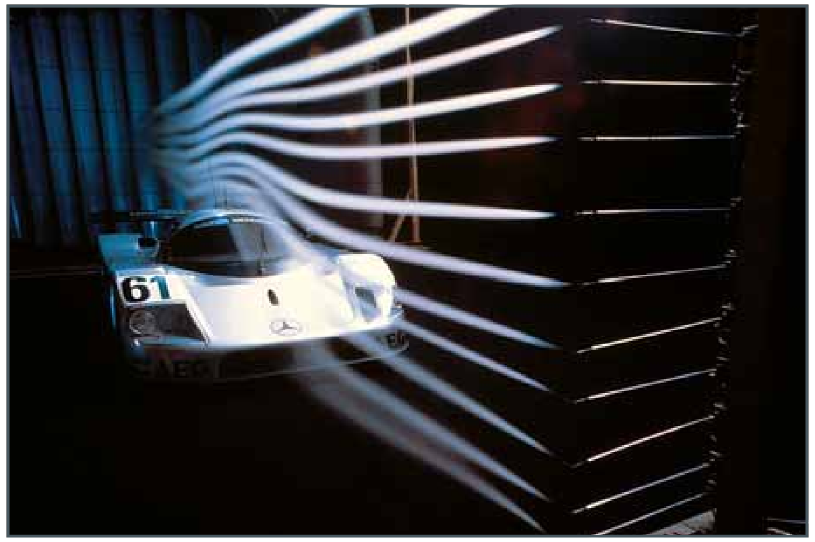
Flow around bodies

The topic of “flow around bodies” plays a key role in any overall curriculum on technical fluid mechanics. The understanding of flows around any shape of a body is crucial in fluid dynamics and aerodynamics.

Fluid simulations (CFD – Computational Fluid Dynamics) now make it possible to calculate the variety of flow configurations for any shape of a body and the resulting drag by digitally solving complex differential equations and displaying them graphically. Nevertheless, experimental research in the lab on the model remains indispensable for a sound understanding.

GUNT can provide you with a varied selection of equipment for demonstrations, to illustrate these topics clearly and specifically in laboratory experiments.

Our experiment and demonstration apparatus for this field is based on the assumption of incompressible, steady external flow.



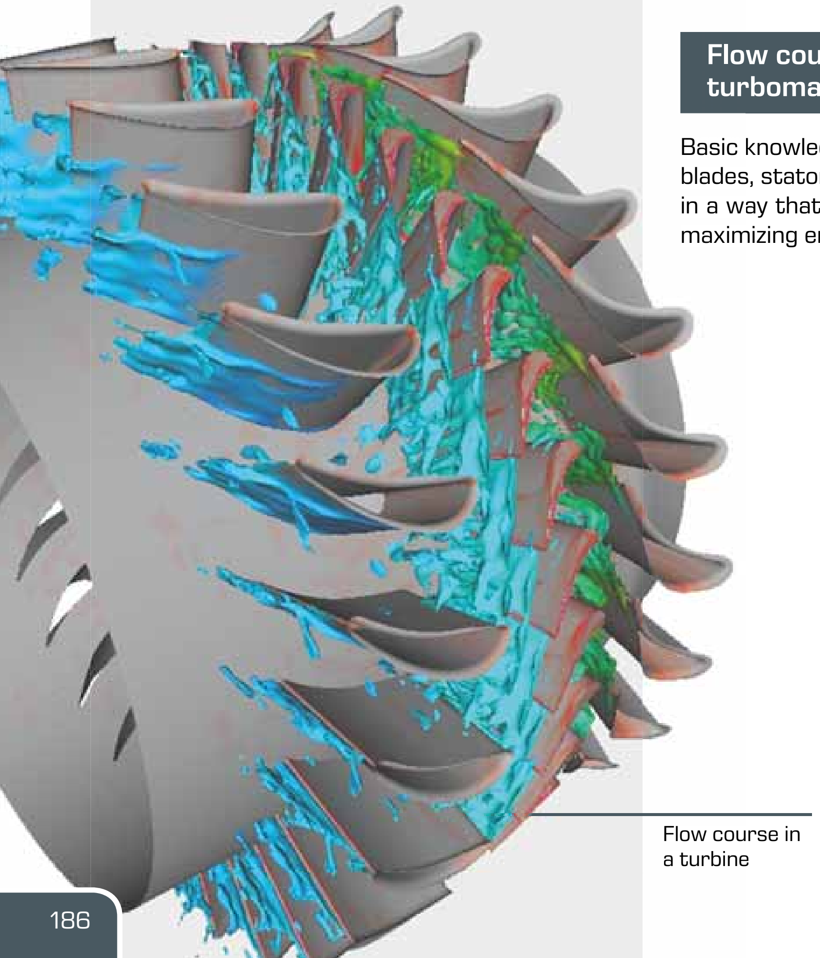
Forces on vehicles

In vehicles – besides aspects of design and branding – the reduction of resistances, generated by flow around the body, plays a vital role. Therefore vehicles are often tested in wind tunnels. The findings from these experiments are incorporated into vehicle development and optimisation.

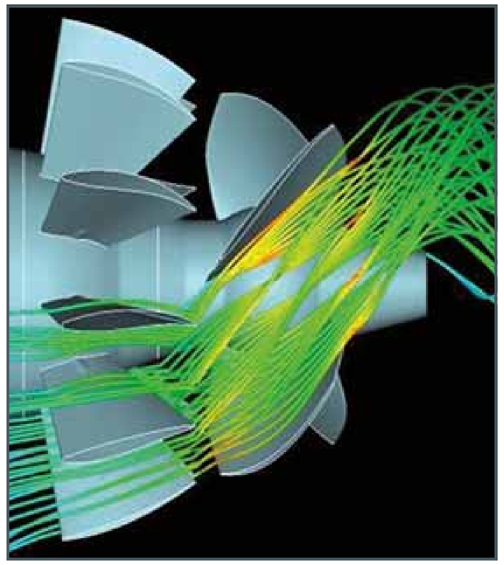
A flow-optimised design can reduce road noise and have a favourable effect on fuel consumption. Thus significant progress is made in striving for energy efficiency.

Flow course in the stator and rotor systems of turbomachines

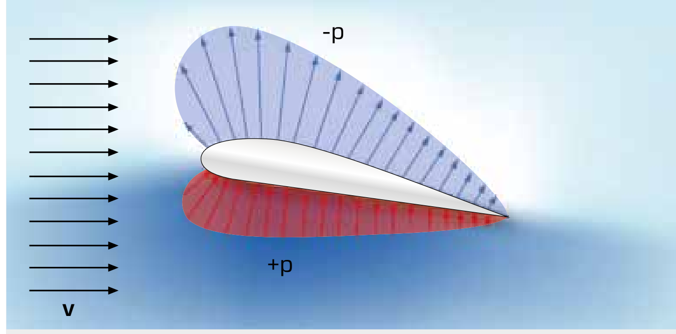
Basic knowledge of flow around bodies is crucial in structural design. Rotor blades, stator and rotor systems, inlets and outlets, etc. must be designed in a way that operating noise and vibration sensitivity are minimised while maximizing energy use.



Flow course in a turbine



Flow course in the stator and rotor system of a turbine



Pressure distribution on an aerofoil

v incident flow,
blue area low pressure on the top side (suction),
red area high pressure on the bottom side

Boundary layer and flow separation on a plate

Boundary layer and flow separation on an aerofoil and landing flap

Forces and pressure curve on aerofoils

Fundamental knowledge about aerofoils is developed by means of wind tunnel experiments. In addition to measuring drag and lift forces, we also offer an instructive experiment for measuring the pressure curve around an aerofoil.

The angle of attack of the aerofoil profile and the average flow velocity can be varied in this experiment.

Boundary layers characteristics of different bodies

The understanding of the structure of boundary layers and their influence on the surfaces of the body immersed in a flow is one of the problems of fluid mechanics that can easily be made accessible to students through appropriate, illustrative experiments.

The table shows an abstract from a common university curriculum. GUNT devices cover this content to the greatest extent.

Learning objectives for the field of flow around bodies	GUNT products
Streamlines, flow field	HM 133, HM 152, HM 153
Pressure/velocity profile of body in a flow	HM 170, HM 225.02, HM 225.04
Boundary layers: laminar and turbulent flow formation, dead wake zone	HM 170.24, HM 225, HM 225.02
Vehicle dynamics, air forces on vehicles	
Force effect when flowing around bodies: pressure and frictional resistance	HM 170, HM 225.04
Forces on structures under surrounding flow: the effect of wind on buildings, water flow around foundations and supports	
Aerofoil: shapes, designs, lift and drag forces as a function of angle of attack and wind velocity	HM 170, HM 225.04
Flow through series of pipes and tube bundles in heat exchangers	HM 153, experimental apparatus in catalogue 3: WL 310, WL 314