virtual vehicle

Thermo- & Fluid Dynamics

Introduction

The area „Thermo & Fluid Dynamics“ adopts a holistic view of the thermal and fluid issues in and around the „vehicle“ system. The simulation and validation of thermodynamic processes leads to a reduction of energy consumption, lower emissions and cost efficiency in vehicle development.

The general procedure in this area is to create different sub-models (e.g. flow and heat transfer models) and then couple them with each other so as to merge the individual parts into a comprehensive numerical model.

For future mobility concepts with increased electrification, the thermodynamic focus will shift from the engine to the thermal conditioning of the battery, electric motor, power electronics, and, in particular, the interior of the cabin. The co-existence of simulation and experimental testing with a coordinated data exchange between these two worlds is essential for the research work.

Main Topics

- ***Thermal Management Systems***
- ***Internal Combustion Concepts***
- ***Thermal Comfort***
- ***HVAC – Systems***
- ***Aerodynamics / Aeroacoustics***

Targets

- ***Reduction of CO_2 emissions***
- ***Environmental friendly vehicles***
- ***Efficient vehicle development***

virtual vehicle

Kompetenzzentrum
Das virtuelle Fahrzeug
Forschungs-GmbH.

RESEARCH ■ TECHNOLOGY ■ INNOVATION

Innovative technologies

VIRTUAL VEHICLE is a leading research and development center with over 200 employees that is dedicated to methods and enabler technology for vehicle innovations. Our world-wide network of partners in research and industry provides us with a strong foundation.

Simulation technology opens up new avenues

Enhanced simulation and development techniques enables early product design, the comparative evaluation of different alternatives and new optimization opportunities – so vehicle development becomes more focused and efficient.

Single components and overall system

Our main focus is on virtual vehicle development. This includes innovative simulation models, effective integration with test procedures and dealing with complex overall systems.

Testing & Validation

VIRTUAL VEHICLE offers comprehensive services in the fields of: NVH & Friction, Engine & Powertrain, Vehicle & Hybrid Safety.

Contact:

virtual vehicle

General Information
VIRTUAL VEHICLE Head Office

Tel.: +43-316-873-9001
Fax: +43-316-873-9002
E-Mail: manuela.kreinz@v2c2.at

virtual vehicle
Thermo- & Fluid Dynamics

Dr. Bernhard Brandstätter
Head of Thermo- & Fluid Dynamics

Tel.: +43-316-873-9026
Fax: +43-316-873-9002
E-Mail: bernhard.brandstaetter@v2c2.at

Managing Director: Dr. Jost Bernasch
Scientific Director: Prof. Dr. Hermann Steffan

Kompetenzzentrum Das virtuelle Fahrzeug Forschungs-GmbH
Inffeldgasse 21A, 8010 Graz, AUSTRIA

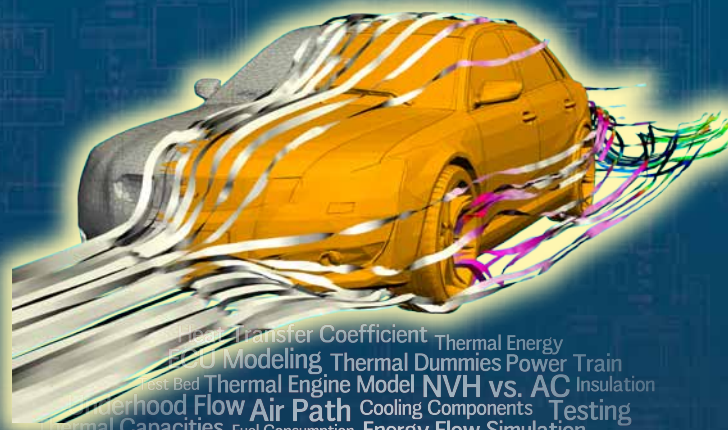
Funding:

bmvit bmwfw FFG COMET Competence Centers for Excellent Technologies Das Land Steiermark SFG

VIRTUAL VEHICLE Research Center is funded within the COMET – Competence Centers for Excellent Technologies – programme by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT), the Federal Ministry of Science, Research and Economy (BMWFW), the Austrian Research Promotion Agency (FFG), the province of Styria and the Styrian Business Promotion Agency (SFG). The COMET programme is administrated by FFG.

virtual vehicle

Thermo- & Fluid Dynamics



Aerodynamics & 3D Simulation

Thermal Management & 1D Simulation

Internal Combustion Concepts

Mobile Air Conditioning

Testing & Validation

www.v2c2.at

Aerodynamics & 3D Simulation

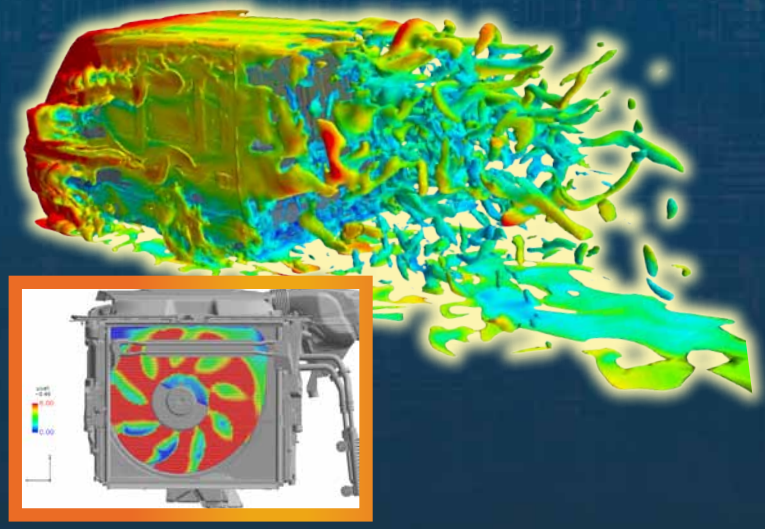
The main focus of the working group „Aerodynamics & 3D Simulations“ is the application of advanced CFD methods, which range from the simulation of the air flow through the engine compartment, the computation of fluid induced noise, over sophisticated multiphase simulation including combustion and soot formation.

Modern model reduction techniques are employed establishing an equilibrium between computation speed and accuracy of the results.

.

Main Topics

- ***Multi-Phase Flows***
- ***Aeroacoustics & Aerodynamics***
- ***Model Reduction***



Mobile Air Conditioning

The work group „Mobile Air Conditioning (MAC)“ of Area „Thermo- Fluid Dynamics“ deals with methods and processes for model based development of energy efficient heating, ventilating, and air conditioning (HVAC) systems for vehicles. The ultimate goal is the verification and the implementation of the comprehensive models, which allow the analysis of the heating, ventilating, and air conditioning system and it's interaction with the control system of the vehicle's thermal management.

Main Topics

- ***Energy Efficient AC-Systems***
- ***Heat Pump Technologies***
- ***NVH vs. AC-Systems***

Thermal Management & 1D Simulation

The 'Thermal Management & 1D Simulation' work group investigates energy fluxes within the vehicle. The optimal distribution of mechanical, electrical, and thermal energy is the key to further reductions in energy consumption in modern vehicles. The group uses a variety of 1D tools that simulate essential vehicle subsystems, including the engine, thermal system, drive train, and electrical components. New models are also being developed that will improve existing software tools and enable the simulation of alternative vehicle concepts, such as hybrid or electric vehicles.

Main Topics

- ***Thermal Behaviour of Drive Train***
- ***Full-Vehicle Simulation (Energy Flows)***
- ***Auxiliaries and Control***

Internal Combustion Concepts

Research on innovative internal combustion for the optimization of combustion relevant parameters with internal (e.g. EGR) and external measures with exhaust gas aftertreatment systems (EAS) is the main focus of the work group „Internal Combustion Concepts“.

The approach of reduction of engine out emission is followed by fundamental research and consequent development of conventional and homogenous diesel combustion concepts and operation strategies for air systems including charging and cooling concepts.

The experimental investigations of EAS, especially selective catalytic reduction (SCR), are massively supported by intensive simulation methodology of emission formation.
Research on operation strategies of hybrid powertrains is done by simulation and with experimental investigations on engine testbed.

Main Topics

- ***Innovative Combustion and Exhaust Gas Aftertreatment Systems***
- ***Thermodynamic Simulation and Experimental Investigation***
- ***Passenger Cars, Commercial and Hybrid Vehicles up to Large Engines***

Testing & Validation

The Testing & Validation work group conducts sophisticated measurements both within the framework of the K2 programme and for external clients. A wide range of research topics and applied methods such as:

- ***Optical Measurements Methods (LDA, PIV, Interferometry, Fluoroescence)***
- ***Thermodynamical Analysis***
- ***Thermal Application Methods***
- ***Aerostatical Measurements***
- ***ViFDAQ (wireless small sized data acquisition system)***

Main Topics

- ***Engine Test Beds***
- ***Dynamometer Test Beds***
- ***Test Bed for Cooling Components***
- ***Refrigerant Cycle Test Beds***
- ***Climatic Chambers***
- ***AC – Compressor Test Bed***
- ***Oil Circulation Ratio Calibration Test Bed***