CAR-Fraunhofer-Workshop

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Automotive research - challenges and contributions of the Fraunhofer Transport Alliance

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Automotive Industry in Facts

- Sales of cars and other light vehicles have fallen in most markets, but especially in North America and Western Europe.
- During the first half of 2008 most markets for vehicles held up reasonably well, but there has been a much more substantial decline in the second half of the year.
- This downturn in 2008 has reversed the growth trend seen in most recent years.
- In 2007 global vehicle production, according to OICA statistics, increased by 5.7% over 2006 to reach 73.1 million.

Source: http://www.icf.at/en/6195/automotive_industry.html

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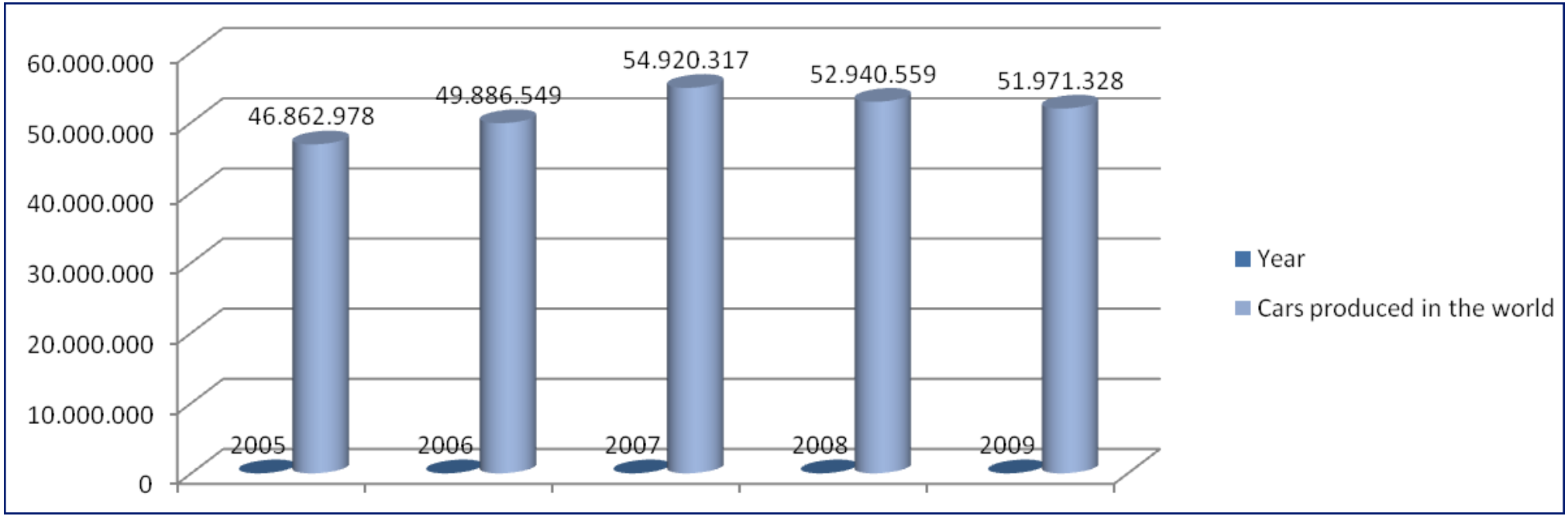
Production of Cars 2005 – 2009 worldwide



- The Indian car market is one of the few keeping the growth in 2008/2009.

http://www.worldometers.info/cars/

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The Fraunhofer Transport Alliance

- Fraunhofer – Europe´s largest organization of applied research – was founded in 1959 in Munich (Germany) and has expanded to more than 50 Institutes, more than 13.000 employees and a budget of more than 1.2 bn €.
- The Fraunhofer Transport Alliance consists of 19 Fraunhofer Institutes of different fields and was found 2003
- The Fraunhofer Transport Alliance focuses and communicates existing core competencies in transport-related research and …
- … develops integrated solutions by means of co-operations between Fraunhofer-Institutes

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The Alliance’s Mission and its R&D clusters

- »The Fraunhofer Transport Alliance develops adequate technical and conceptual solutions for the public and industry partners and puts transport-related research solutions into practice.«

Transport Alliance Core Groups – in accordance with major Industry Sectors

- Transport Alliance Core Groups:
  - Automotive
  - Rail
  - Galileo/ Satellite Navigation
  - Aviation
  - Waterborne

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Automotive Competencies

- Safety, Reliability, Durability and Testing
- Production-, Processplanning and –optimization
- Inspection and Quality Assurance
- Modeling and Simulation
- Processing, Manufacturing and Assembling
- Materials and Structures
- Development Tools and Organization
- Comfort, New Functions and Services
- Logistic, product and material cycles

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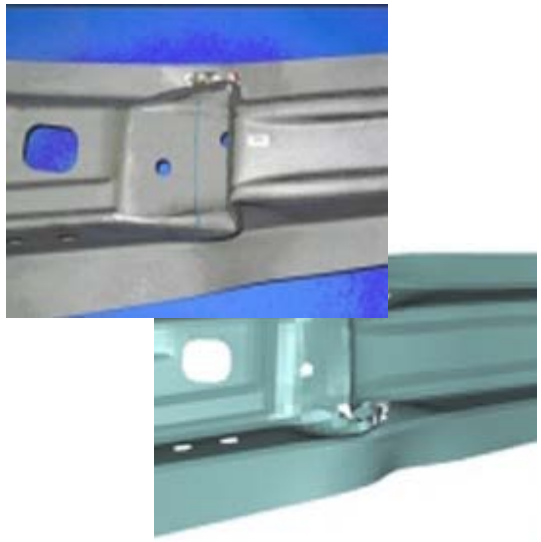
Crashworthiness



Simulation and experimental verification of B-pillar under crash loading

Approach

- Development of damage models to predict the crash behavior of automobile components

Customer Benefit

Development and verification of component designs with increased crashworthiness by means of:

- Advanced material models
- Reduction of expensive empiric development and test programs
- Improved process integration and accuracy of crash simulation codes
- Conception, design and implementation of actuators and their system integration

R&D Services

- Strain rate dependent material characterization and modeling
- Assessment of welds and joints subjected to crash loading
- Coupling of manufacturing process and crash simulation
- Implementation of crash simulation into multidisciplinary optimization
- Consulting by crashMAT “Fraunhofer Center for Crash re Material Characterization”

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Structural Durability and Service Assessment

Testing of a trailer coupling device using a multiaxial test rig

Approach

- Evaluation of structural durability covering the whole vehicle design process
- Simulation of vehicles in operation allow the evaluation of component loadings and stresses based on FE-model analysis

Customer Benefit

- Development and verification of structural durability of automobile components using simulation
- Analyze, optimize different design variants in early development phases
- Reduction of cost-intensive experimental development
- Designing of technically mature and safe products
- Utilization of lightweight construction potentials

R&D Services

- Numeric structural durable pre design of systems and components
- Characterization of material and component performance, equipment condition monitoring
- Fracture and deterioration failure evaluation, Virtual Testing
- Reliability evaluation, Environment simulation
- Evaluation of material performance under thermo cyclic conditions
- Lifetime prediction of thermo mechanical stressed components

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Light-Weight Constructions

Monitoring system for impact and delamination detection

Approach

- technological loops to design lightweight constructions by the means of material science, manufacturing technologies and tools treating structural dynamics, mechanics and durability

Customer Benefit

- Material adequate usage of innovative lightweight materials and material composites
- Evaluation and optimization of lightweight components
- Reduction of material and resource usage and energy consumption

R&D Services

- Development and verification of lightweight structures (e.g. structural durability)
- Rapid Prototyping and shorter development periods
- Experimental and numerical simulation of lightweight components
- Deterioration and failure simulation (e.g. phenomenological, micromechanical,..)
- Material characterization and modeling
- Structural Health Monitoring

Bundesministerium für Bildung und Forschung

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Active Systems

Approach

- By using, especially adaptive, active structure technology higher demands on comfort standards, improved safety and functionality, online structure controlling and optimized lightweight engineering can be given.

Customer benefit

- New active technological concepts to optimize mechanical structures
- Increase of lightweight design potentials
- Evaluation and assurance of the reliability of active systems
- Increase of safety and comfort

R&D Services

- Evaluation of loads, system identification and modeling
- Conception of active/adaptive structures for product optimization
- Complex structural systems, performance assessment and early feasibility studies
- Design and realization of active structures
- Controller development and functional demonstration
- Development of methods to assess the system reliability of active structural systems
- Functional verification with respect to operational loads

InMAR

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Polymeric Materials and Manufacturing

Sample: Frontend

Approach

- Decreasing product lifetimes by time and cost reduction for development
- optimization of materials and production processes is an important factor

Customer Benefit

- Development, modification and selection of customer specific material systems and production processes
- Efficient support during the development process
- Market-orientated production processes and sizes

R&D Services

- Materials with specific characteristics
- Material modification for certain processing procedures
- Recycling and "closed loop" strategies
- Material reprocessing
- Material testing and characterization
- Sampling of materials, tools and production processes
- Design of production processes
- Tool engineering, Procedure development

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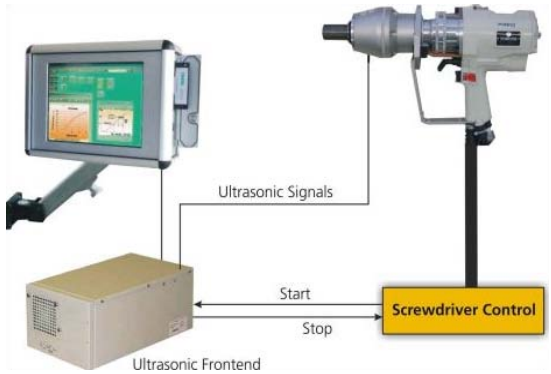
Non-destructive Testing / Quality Assurance



Sample of a non-destructive online evaluation of the exact preload force of a screw (integrated ultrasonic detector in the srewnut)

Approach

- It is essential to find optimal physical measuring methods for non-destructive testing
- Material durability may be forecasted

Customer Benefit

- Non-destructive testing for the 100%-inspection and statistical process control
- Prevention of defective goods and destructive testing
- Documentation of product quality (testing certificate)
- Savings of quality and post processing costs, Increase of productivity

R&D Services

- Detection of processing and operational failures
- Non-destructive determination of residual stress
- Determination of material characteristics and their degradation
- Testing in an DIN EN / ISO IEC 17025 accredited service centre or on-site
- Fully automated testing of complex shaped components (exterior and interior testing) by specialized scanning systems

Feasibility Studies

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New Service Development

Engineering new services

Approach

- Supporting automobile producers during the process of service development
- Main focus is on selection of adequate methods, a strong integration of the market and customer views

Customer Benefit

- New service concepts increase customer satisfaction and retention
- Efficient development and market introduction of new services

R&D Services

- Implementation of new service development processes
- Business models for new services in the automobile industry
- Development of new services from the idea to market entry
- Training and qualification of service employees

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Human Factors and Usability Engineering in Vehicles

Usability Engineering in the virtual reality

Approach

- Integrated contemplation of development processes allows the holistic optimization of the product design process
- Continuous support by information technology

Customer Benefit

- High degree of maturity of HMI concepts early in the design process
- Valid information for decisions on innovations
- Independent evaluation of system and interaction concepts
- Multi-disciplinary solutions
- Integration of Usability and Software Engineering

R&D Services

- Virtual and Rapid Prototyping of prototypes and HMI
- Usability Testing in the driving context
- Solutions and tools for Usability and Software Engineering
- Tools for the analytical evaluation of the HMI
- Driving simulation and behavioral research
- Solutions for driver state diagnosis and vigilance managemer
- Alternative and innovative HMI concepts

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Automotive Software Engineering

Approach

- Automotive software engineering includes processes, techniques, methods, and tools that are specially designed for the automotive industry

Customer Benefit

- Competitive development productivity
- Adherence to the demands of quality
- Verifiable process and product quality
- Flexible version management

R&D Services

- Process modeling
- Counseling on the model-based development process
- Process assessment; assessment preparation
- Planning and initiation of software product lines
- Software structure evaluation and restructuring
- Component design
- Testing technology for requirements, design and code

HITACHI Inspire the Next

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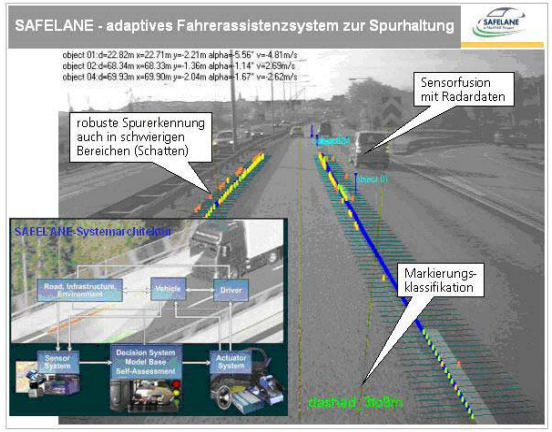
Driver – Assistance – Systems



SAFELANE - adaptive driver-assistance-system to stay on tracks

Approach

- To mechanically understand driving situations powerful sensor systems for usage in vehicles are developed. Thereby new integration theories are used by combining single sensors of different tasks.

Customer Benefit

- Development and evaluation of novel assistance components from the concept to the start of production prototype
- System development and validation under special consideration of the ergonomic requirement (Human Factors)
- Rapid Prototyping and simulation of system concepts
- External and independent evaluation of system concepts, prototypes and products
- Customer specific test in the driving simulator and test vehicle

R&D Services

- Software development for sensor-, picture-, und video data usage in vehicles, especially for track and obstacle recognition
- Development of vehicle- and driver- based security- and warning-functions (e.g. for collision avoidance and to stay on tracks)
- Driving test with driving simulator as well as with vehicles on test tracks and with real traffic

SAFELANE
a PReVENT Project

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Vehicle acoustics

Micro-perforated absorber used as engine thermo protection shield

Approach

- Development of Acoustic devices and components for the interior of a vehicle
- Devices are e.g. micro-perforated components for wheelhouses and engine encapsulations, or noise absorbing aluminum foams for exhaust systems and panels.

Customer Benefit

- Application and acoustic testing of devices and components
- Target aimed acoustic optimization of components, units and the vehicle as such
- Weather independence evaluation and optimization of vehicle exterior and interior acoustics inside our own acoustic laboratories
- Detailed characterization and further development of devices

R&D Services

- Development and testing of acoustic absorbers and devices
- Experimental and numerical simulation of acoustic devices
- Planning, design and manufacturing of acoustic test facilities for the automotive industry
- Analysis and optimization of vehicle noise on own acoustic test facilities

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Vehicle Climate

Climate measurement device “DRESSMAN“ for the evaluation of thermal comfort. Here inside a vehicle.

Approach

- A special climate measurement device called DRESSMAN is designed for thermal comfort measurements

Customer Benefit

- Optimisation of components and devices to improve the climate and comfort inside the vehicle
- Development of technologies to improve the climate inside a vehicle

R&D Services

- Measurement of thermal boundary conditions in vehicles
- Questioning of subjects to investigate thermal comfort
- Analysis and optimisation of climate and comfort inside vehicles
- Development of comfort models

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Exchangeable products and recycling

Approach

- This recycles used materials as secondary raw materials back into the cycle

Customer Benefit

- Spare part security
- Availability of low price exchangeable parts in new parts quality
- Environmental-friendly product design and easy to disassembly
- Recovery of high-quality secondary raw materials for further use in automobiles
- Conformance with national and European waste legislation
- Better reputation through an ecological orientation

R&D Services

- Development of disassembly workflows and recycling strategies
- Secure disposal of end-of-life vehicles
- Concepts for the recirculation of dismantled parts
- Evaluation/benchmark treatment of different techniques
- Logistic networks

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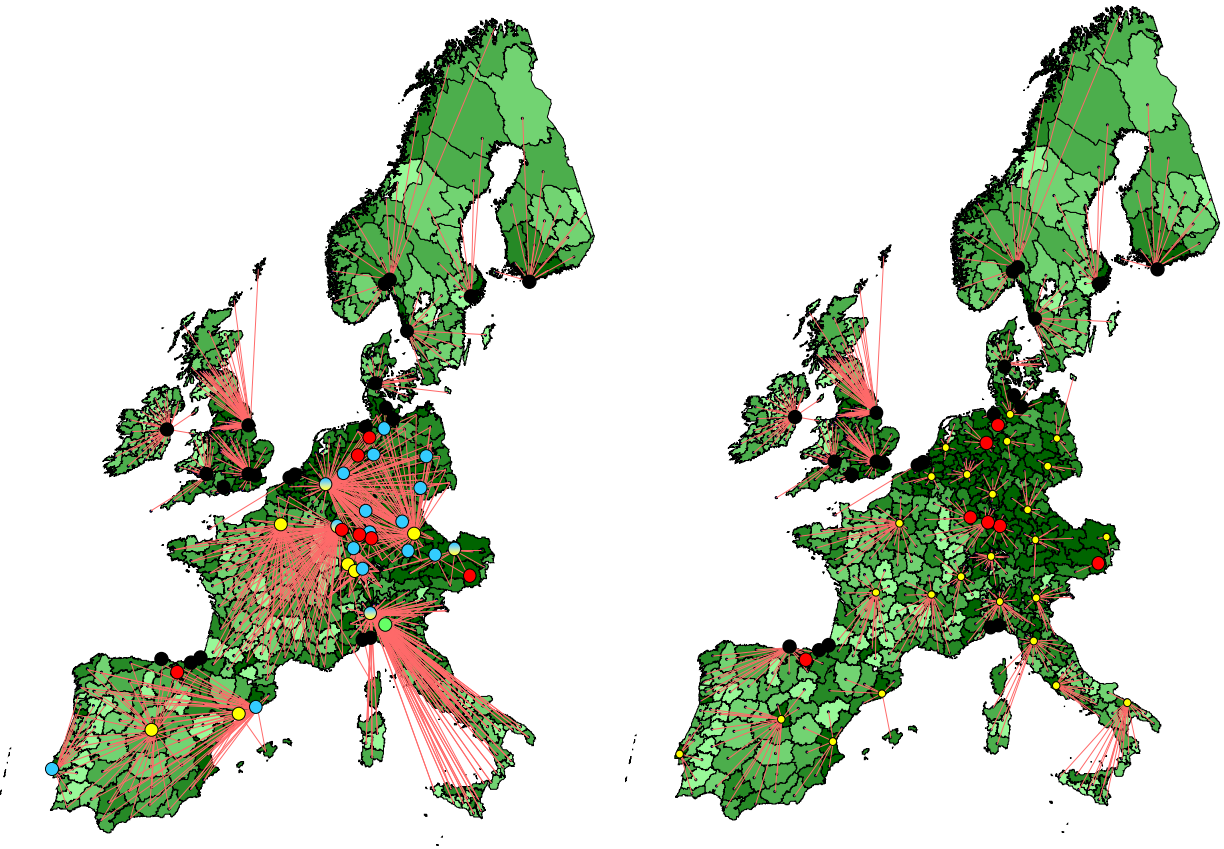
Design and optimization of transportation networks



R&D Services

- Distribution and procurement logistics
- Sales and supply logistics - Analysis, planning and optimization of transportation logistic system
- Sales logistic - Optimal commodity distribution
- Spare parts logistic - Optimal spare parts supply
- Controlling and benchmarking - Transparency and overview
- Strategies for transport logistic
- Location, allocation and intermodal networks
- Weakness and optimization potentials

Mercedes-Benz

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Selection of an logistic planing tool

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Tasks

- Selection of an software planning tool for transport planning in the fields of distribution, procurement, spare parts distribution and automobile industry
- Professional management and organizational assistance at the selection of software providers
- Definition of requirements based on the planning methodology
- Preperation and accomplishment of an tender

Results

- Software tool testing in workshops
- Evaluation of logistic planning system engineering, functional range and offers prices
- Comprehensive market analyses with software system and implementation reference

Test case for Inland Terminals - Initial situation and Project contents

- E.H.Harms operate in several locations in Europe in the field of automobile handling
- Different processes and process understanding

Fraunhofer IML developed and presented:

- Standard and repeatable processes
- standard concepts and process understanding
- measurable and for this reason comparable processes (KPI)
- standard image
- Framework for process optimization, IT-structure and controlling
- Background for company wide, standard quality management

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Automotive Research Challenges

- People need mobility!
- Research is particularly indispensable within the following ranges:
  - Energy efficiency and emissions reduction
  - Safety
  - Sustainable development
  - Usability & Comfort
  - Low costs

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Thank you for your attention.

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