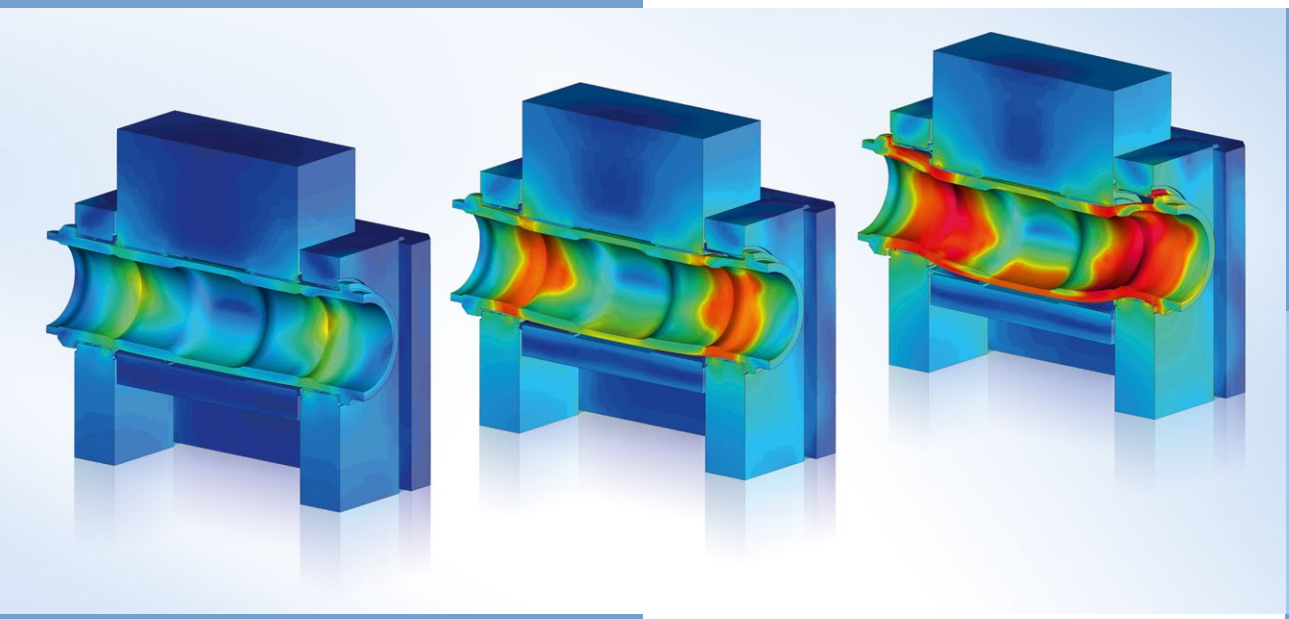
Simulation • Analysis • Optimisation

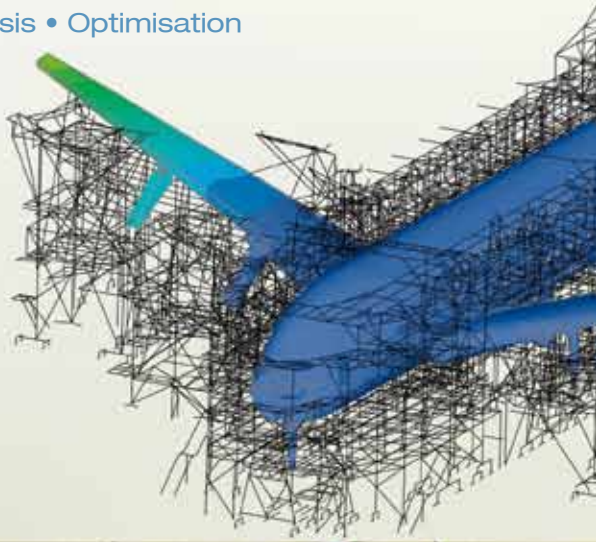


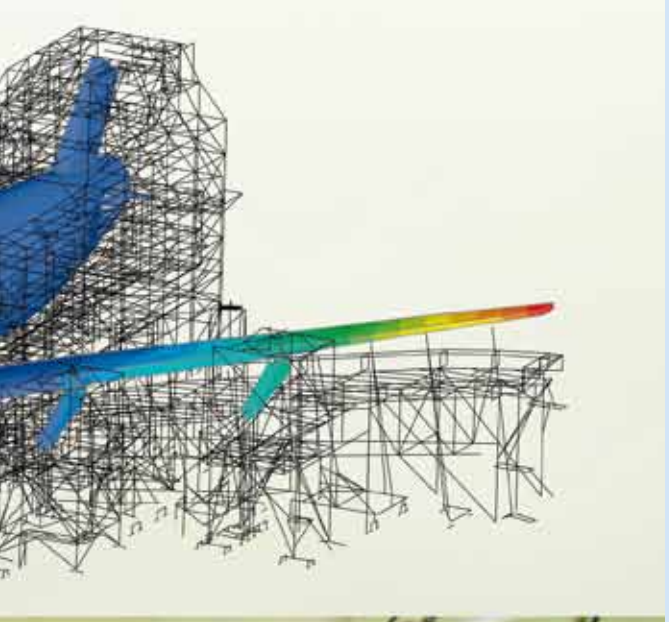
Computer Aided Engineering

IABG

Computer Aided Engineering

Simulation • Analysis • Optimisation





Verification of test rig for fatigue tests

Simulation • Analysis • Optimisation

Increasing demands on new products in terms of functionality, quality, costs and development time can only be met by employing the latest in CAE methods on powerful computers.

Mastering a wide range of methods is essential for virtual product development. We can actively support you in this respect with over 30 years of experience and expertise. On request, we run relevant tests at our own test facilities in addition to our computing services.

We also offer you independent development of components in cooperation with our various specialist departments.

Our forte lies in analysing and providing solutions for innovative and complex tasks. The primary aim is always to improve the quality of your products, reduce costs and shorten development time. We use a variety of standard CAE tools for our simulations.

Our service portfolio

- CAD design, FE modelling
- Strength analysis, joining techniques
- Fatigue Strength
- Structure optimisation
- Oscillation, vibration
- Non–linear structural dynamics,
- Shock, fluid–structure interaction
- Flow simulation, temperature fields
- Method development, software development

Fields of application

- Automotive
- Aerospace
- Rail vehicles
- Defence technology
- Materials–handling technology
- Production technology
- Test planning
- Wind energy

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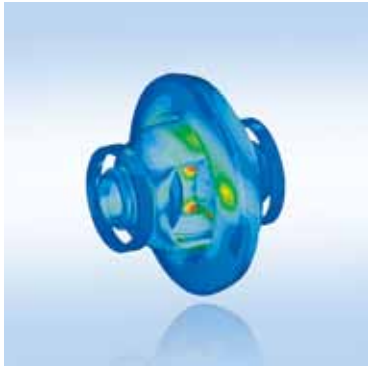
Strength evaluation for demolition excavator for dismantling nuclear power plants



Above: Model of a crankshaft segment

Centre: Strength analysis of a differential cage

Below: Buckling analyses for CFRP structures

CAD design, FE modelling

We produce designs according to your specifications or modify analysed designs based on calculation results. We employ parametric 3D CAD sys–tems to enable quick and flexible adaptation of geometries.

Conclusive calculation results require appropriate FE models that are matched to your particular specifications and conditions. In the modelling process, standard–format 2D and 3D CAD geometries are imported. The data is corrected and prepared for meshing. Depending on the application we use beam–, shell– or solid elements with automatic tetrahedron or hexahedron meshing.

Software used

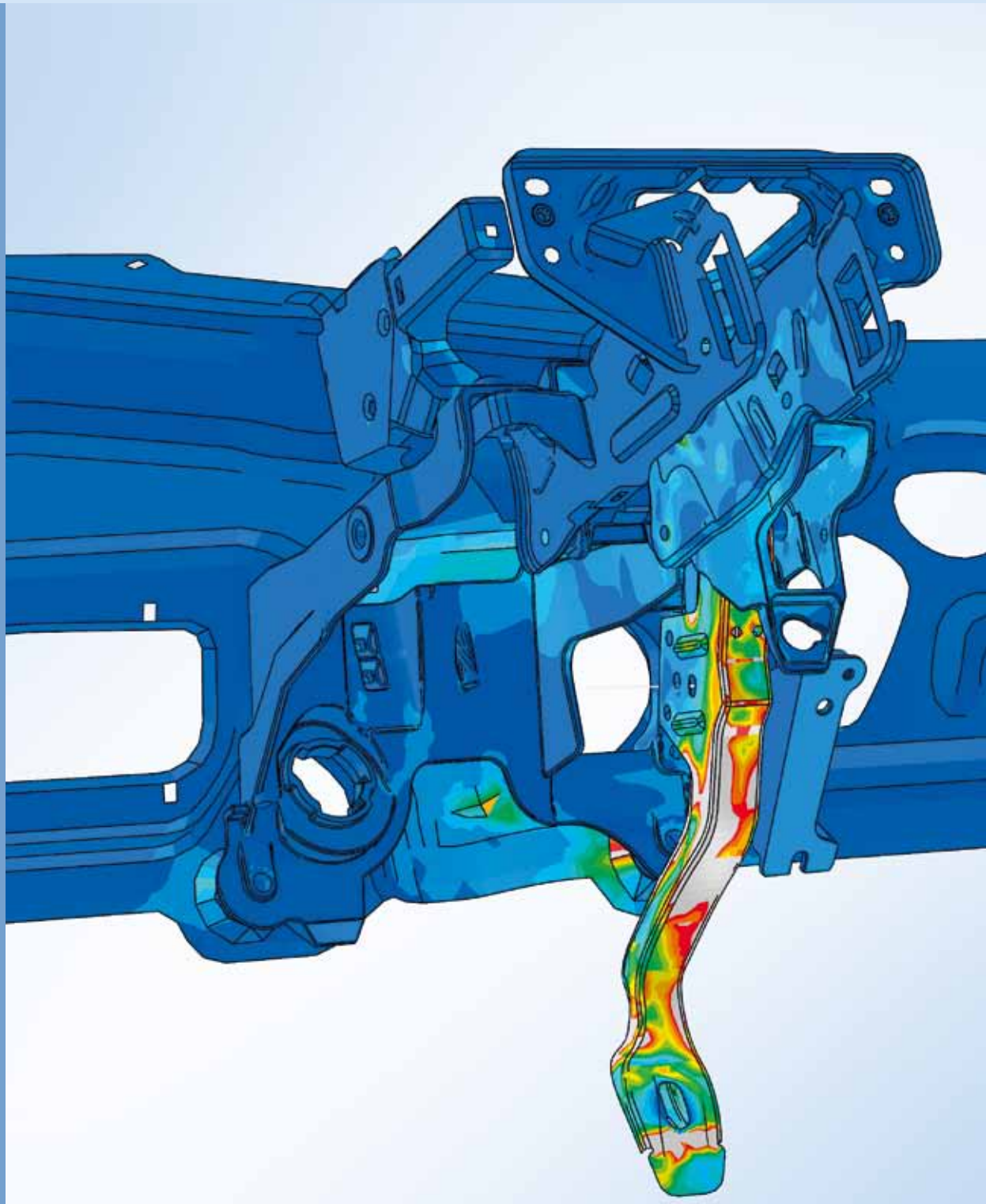
- Catia V5, Pro/E
- Medina, ANSA HyperMesh, MSC.Patran, RStab

Strength analysis, joining techniques

We examine the structural properties of your designs and connections using linear and non–linear FEM as well as analytical methods to give impulses for focused improvements. We perform computerised strength analyses in compliance with all the current standards and guidelines. In cooperation with our test departments, we provide independent planning and administration of tests, for example for validating and determining load data and material parameters.

Software used

MSC.Nastran, MSC.Marc, ANSYS, Abaqus, MDesign, Hexagon

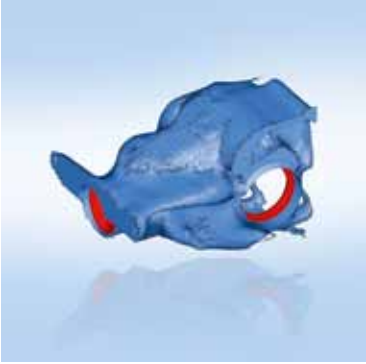


Elastic–plastic fracture simulation of a pedal box

Above: Fatigue life assessment of a swivel bearing

Centre: Parameter optimisation of a vehicle framework structure

Below: Topology optimisation of a rear axle gear housing



Fatigue Strength

We employ computer analyses to help you optimise your components and testing procedures and implement the resulting concepts in design. Our specialists in multibody simulation, test bench development and fatigue testing provide tailored solutions for your specific tasks:

- Load data simulation using MBS or global FEM models
- Numerical fatigue life assessment
- Damage based shape optimisation
- Fatigue life assessment in compliance with industry–specific standards and regulations
- Accompanying fatigue testing

Software used

FEMFAT, nCode DesignLife, Rifest

Structure optimisation

Permanent increasing demands for lightweight components require the use of CAE methods in the early development phase to optimise com–ponent geometry. In the process, we perform optimisation analyses with static and dynamic load cases, taking into account restrictions such as stiffness requirements. Manufacturing constraints can also be considered at this stage, so that the boundary conditions that apply to the subsequent manufacturing process become part of the optimisation.

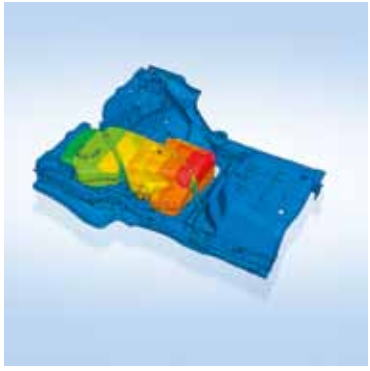
We provide the following range of services for optimising your component structure:

- Topology optimisation to determine the optimum component shape based on the available space
- Refeeding of the optimum shape in a CAD model
- Shape optimisation to further improve stress distribution at critical zones
- Numerical optimisation of designed space and wall thickness with parameterised concept models
- Predictions about the functional feasibility of a new development and dimensioning of an optimum structure

Software used

TOSCA, Optistruct, MSC.Nastran

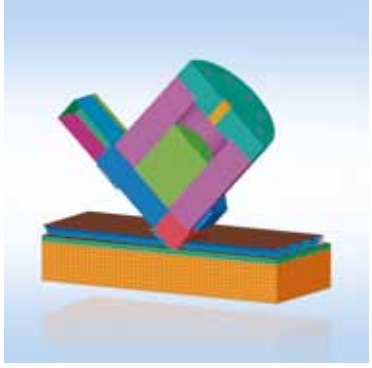
Shock analysis of Frigate F124



Above: Arrival of shock wave on structure

Centre: PSD response analysis of fuel tank

Below: Crash simulation of a shield dome during dismantling of a nuclear power plant



Oscillation, vibration

Our service portfolio ranges from modal analysis to response analysis through to transient dynamic calculation and earthquake simulation.

A validated FE model is required for quantitative prediction of vibration properties. We create these models based on measured dynamic properties or we rework existing models. The objective is to achieve the best possible match between the Eigen frequencies and natural modes based on experiments and simulation. This model update can be achieved manually or by using numerical optimisation methods.

Software used

MSC.Nastran, ANSYS, Abaqus

Non-linear structural dynamics, shock, fluid-structure interaction

Our experience in the numerical analysis of highly dynamic loaded components and complete systems for all sorts of terrestrial, naval and airborne vehicles as well as for stationary objects provides you with benefits regarding the following phenomena:

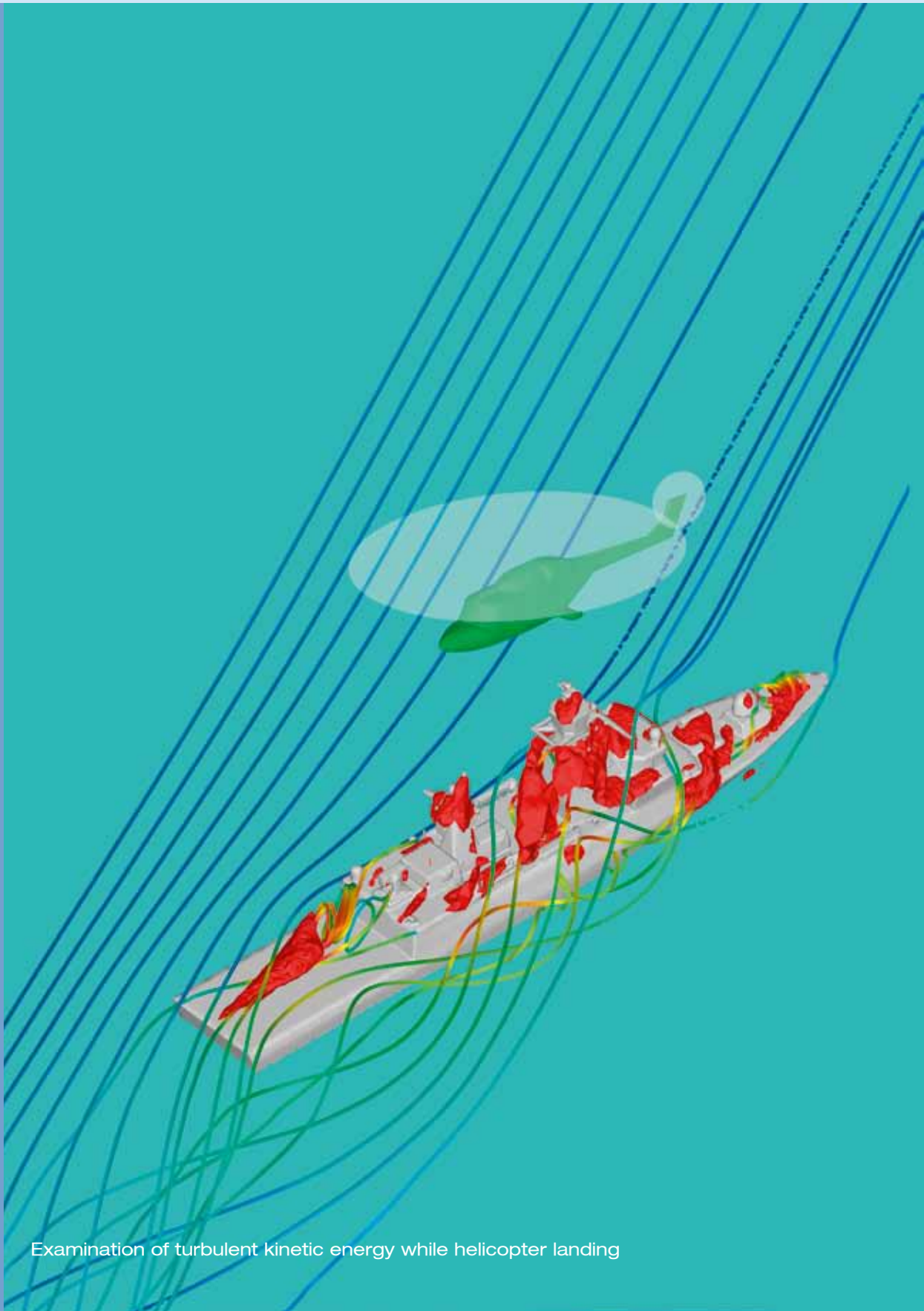
- Large-scale deformation, fracture and post-fracture behaviour
- Plasticity and strengthening as a function of the strain rate
- Inhomogenity and anisotropy of stiffness (fibre composite material)
- Rubber-elastic behaviour (elastomers)
- Fluid-structure interaction in the case of detonations
- Propagation of stress waves

Our service portfolio

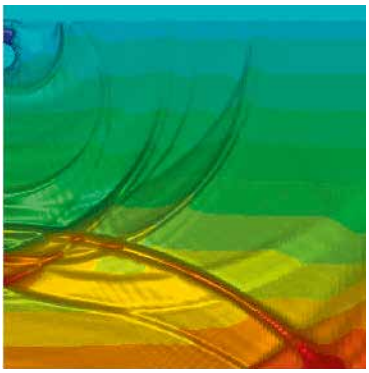
- Safety analyses with regard to deformation, failure and shock
- Crashworthiness for vehicles and transport containers (e.g. CASTOR casks)
- Simulation of the opening behaviour of convertible tops
- Simulation of penetration processes, e.g. turbine blade impacting turbine housing
- Pyroshock loading of aerospace structures
- Pre- and post-shot analyses of underwater explosions including technical consulting for experiments
- Analysis of survivability/vulnerability of ships, submarines and other underwater vehicles

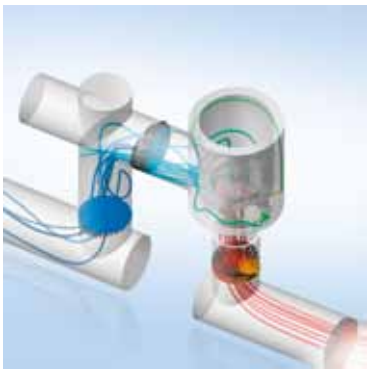
Software used

DYSMAS, DYNA, Abaqus, ANSYS, PAMCRASH



Examination of turbulent kinetic energy while helicopter landing

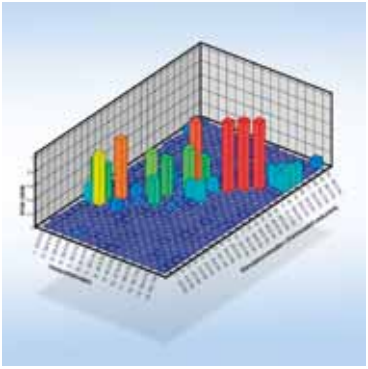




Above: Shock wave structure of an underwater detonation

Centre: Throttle simulation

Below: Automatic model update (MAC value comparison)



Flow analysis, temperature fields

Complex flow patterns can only be analysed experimentally, if at all, in extremely costly experiments. CFD procedures offer a good alternative to this. CFD is used to optimise flows and also in prototype design. In this way, our customers obtain information about flow size, loads, pollutant distribution or other relevant parameters. Thermal loads cause stress in structures. Here we calculate temperature fields, heat transfer and the resulting structure load, also in combination with flow simulations.

Simulation range

- Stationary, non–stationary, laminar, turbulent, compressible, incompressible
- Multiphase flows
- Chemical reactions and combustion
- HVAC (Heating, Ventilation, Air Conditioning)
- Thermally induced stress
- Aero acoustics

Areas of application

- Air conditioning of buildings
- Engine compartment flow–through
- Exterior aerodynamics of vehicles and buildings
- Flows in filters, silencers, catalytic converters and clean rooms
- Determining pollutant concentrations (occupational safety)
- Test bench design
- Thermal shock/thermal fatigue

Software used

ANSYS CFX, Star–CD, DYSMAS, Tecplot, MSC.Nastran, Abaqus, ANSA

Method development, software development

We have extensive experience in developing methods ranging from the elaboration of concepts and solutions to the development of specific procedures and algorithms through to the implementation and application of software tools. These methods are frequently employed to simplify and/or automate complex and time–consuming procedures. We also provide user–friendly interfaces to make applications much simpler for our customers.

Range of services

- Automatic analysis of bolted and riveted joints for large models
- Fatigue life assessment of components using random excitation (e.g. rough road track) based on PSD
- Automatic modelling of bearings for gearboxes
- Combined calculations, e.g. FE and MBS, CFD and FE,FE optimisation and fatigue life analysis
- Development of powerful pre– and post–processors

Software used

Fortran, Java, C++, Script languages (Python, APDL, etc.)

AUTOMOTIVE

INFOCOM

MOBILITY, ENERGY & ENVIRONMENT

AERONAUTICS

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