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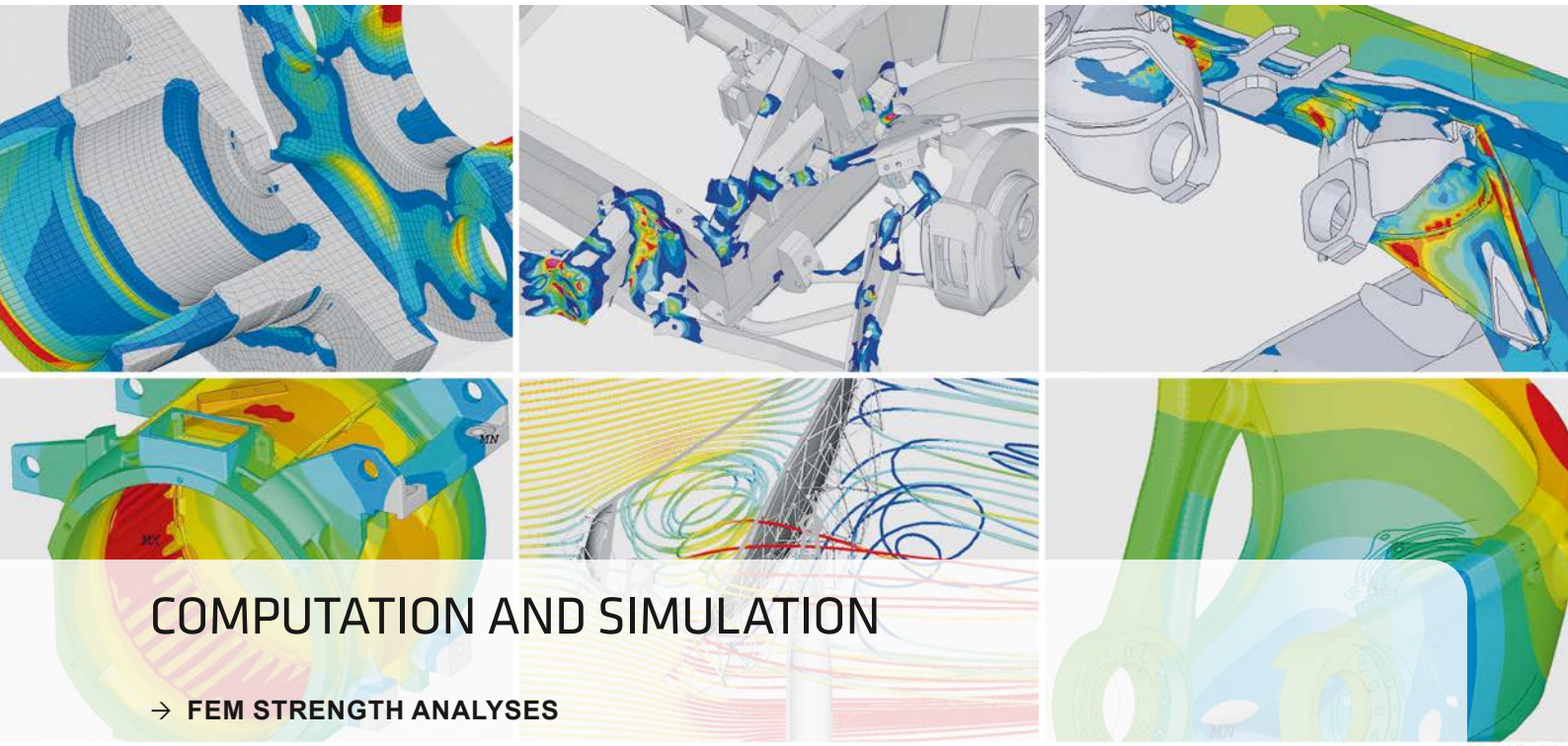
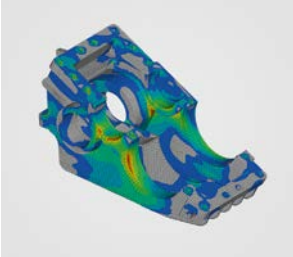


COMPUTATION AND SIMULATION

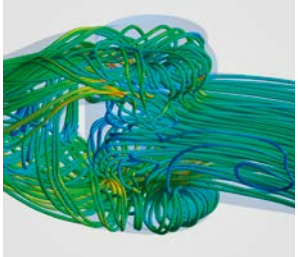
- → FEM STRENGTH ANALYSES
- → VEHICLE SAFETY
- → CFD FLOW ANALYSES
- → OPTIMISATION OF COMPONENTS

OUR SERVICES AT A GLANCE



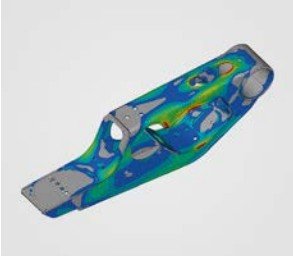
FEM STRENGTH ANALYSES

- → Linear, non-linear as well as static and dynamic structure calculations
- → Dynamic collision assessments in the field of automotive, railway as well as medical devices
- → Inertia, damping effects and vibration behaviour taken into consideration
- → Buckling, stability and damage analyses
- → Multi-body analyses as the basis for strength calculations
- → Transport, earthquake, explosion as well as positive and negative pressure simulations
- → Assessment of emergency stop effects and shock calculations incl. technical documentation



CFD FLOW ANALYSES

- → Flow calculations with fluids, gases or mixtures
- → Calculation of flow velocity, flow distributions and pressure losses
- → Laminar and turbulent flow behaviour
- → Single and multi-phase flows – compressible and incompressible media
- → Interaction with the surrounding construction (fluid structure interaction)
- → Filling procedures with free fluid surfaces including sloshing
- → Calculation of wind loads on components and structures



STRENGTH VERIFICATION

- → Evaluation of fatigue strength according to the applicable procedures and norms
- → Report preparation for testing or certification authorities
- → Strength verification of adhesive and riveted connections
- → Testing of fatigue strength of plastics
- → Evaluation of stresses in weld seams
- → Evaluation of stresses from the spectral vibration analyses ('vibrating table')
- → Systematic calculation of high duty bolted joints

TEMPERATURE FIELD ANALYSES

- → Stationary and non stationary temperature field calculations
- → Thermo mechanical analyses
- → Heat transfer via convection, radiation and conduction
- → Assessment of structural behaviour taking thermal expansion and contraction into account
- → Coupling of temperature field- and flow analyses
- → Thermal flow simulations with chemical reactions
- → Thermo shock simulations

The extensive portfolio and the many years of expertise in the field of computation and simulation bring our customers a distinct competitive advantage in engineering.

Viktor Schmidt
COO invenio Technical Simulations GmbH

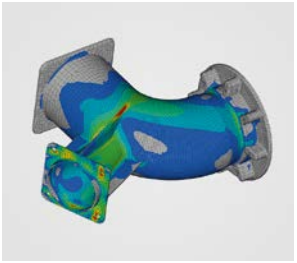
OUR SERVICES AT A GLANCE

VIBRATION ANALYSES

- → Modal analyses for determining the eigenfrequencies
- → Spectral analyses – simulation of a vibration table test
- → Dynamic response analyses in time and frequency range
- → Simulation of fatigue vibration strength
- → Identification of deformations due to vibrations
- → Stiffness optimisation to avoid resonance effects
- → Determination of the required damping properties

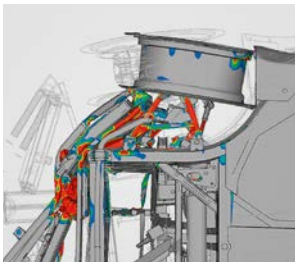
EVALUATION OF RESULTS BASED ON NORMS AND GUIDELINES (EXCERPT)

- → DIN EN 12663 – Structural requirements for rail vehicle bodies
- → DIN EN 13749 – Method of specifying the strength requirements of bogie frames
- → DIN EN 15227 – Requirements for collision safety for rail vehicle bodies
- → DIN EN 61373 – Shock and vibration tests
- → Eurocode 3/9 – Measurement and construction of steel structures / aluminum structures
- → FKM-Guideline for strength assessments on machine components
- → DVS-Guideline 1608/1612 – Form and fatigue strength evaluation of weld connections



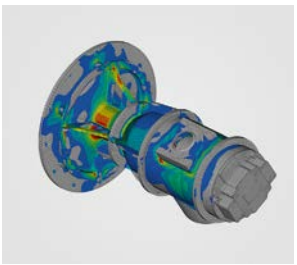
VEHICLE SAFETY

- → Crash analyses of vehicle structures and components
- → Airbag analyses – Airbag door opening and loading on adjacent components
- → Analytical design of the front of the vehicle with respect to pedestrian safety
- → Calculation of passenger protection in front and side impact collisions
- → Interior design for the cockpit, greenhouse and door trim
- → Seat calculations including seat belt and mountings
- → Design of substitute tests for component development
- → Computational design of HV batteries and enclosures for e-vehicles



OPTIMISATION OF COMPONENTS

- → Geometry optimisation based on strength analyses
- → Improvement of flow and thermomechanical parameter
- → Analyses on the use of alternative materials
- → Avoidance of critical stress singularities
- → Weight reduction compliance with strength and stiffness requirements
- → Parameter optimisation, for example in occupant restraint systems
- → Proposals for solutions taking structural feasibility into account



Our experienced and highly motivated CAE team with its broad spectrum of services is the guarantor of qualified and effective support for our customers in their development projects.

Danny Kulp
Team Manager CAE Automotive

YOUR CONTACT AT INVENIO

invenio Technical Simulations GmbH

Viktor Schmidt
Halskestraße 3–5
47877 Willich

P +49 (2154) 8874-10
willich@invenio.net

invenio Technical Simulations GmbH

Danny Kulp
Halskestraße 3–5
47877 Willich

P +49 (2154) 8874-18
willich@invenio.net

WWW.INVENIO.NET

REFERENCES (EXTRACT)

AUDI | AVL

BMW | BOEHRINGER INGELHEIM | BOMBARDIER | BORGWARNER

BOSCH | BRAUN | BRUKER | BSH

CARIAD | CONTINENTAL | CWS-BOCO

DAIMLER TRUCK | DANA | DB | DENTSPLY SIRONA | DEUTZ | DÜRR DENTAL

EBERSPÄCHER

FORD | FRESENIUS | FREUDENBERG

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OHM & HÄNER

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TBH | TENNECO | TI | TOMRA | TRUMPF

VAILLANT | VALEO | VITESCO | VOLKSWAGEN | VONROLL AUTOMOTIVE

WEBASTO | WEIDPLAS

YANFENG | YAZAKI

ZF