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book of abstracts

BETA SIMULATION SOLUTIONS

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Abstracts

Session 1

HUMAN BODY MODELLING – ON THE ROAD TO VIRTUAL TESTING

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KEYWORDS -
Human Body Model, HBM, Virtual Testing, ATD

ABSTRACT
Virtual human body models (HBMs) are state of the art tools for prediction of human kinematics and injury risks for all road users in impacts inside and outside the vehicle. HBMs offer significant benefits over anthropometric test devices (ATDs), both physical and virtual, that have traditionally been used to develop, evaluate, rate and homologate protection systems in passenger vehicles. The ATDs are developed for repeated use without breaking. Hence, they are robust with a limited level of detail. Injury risk is predicted with indirect measures. The ATDs are developed for predicting human response for loading in one direction, either frontal, lateral or rear. The virtual models suffer from the same limitations as the physical counterpart due to the fact that the models are aimed at being exact virtual replicates of the physical ATDs. Some of the benefits with HBMs are that human anthropometry, posture and material properties can be represented in detail. The injury mechanism can be assessed in detail with direct physical parameters related to the injury. Integrated safety can be assessed by including representation of active human musculature. The HBMs can be morphed into a family representing the population of vehicle occupants. The HBMs are omni directional meaning that the models are capable of predicting human kinematics and injury risk for all loading directions.

While the use of computer-aided engineering (CAE) has increased significantly in the industry its use in regulations and consumer information programs is still uncommon. However, Euro NCAP has taken the first step by including monitoring the World SID CAE model predictions in the far side load case in the 2025 assessment program. Euro NCAP has also announced the inclusion of HBMs in frontal impact assessment starting with monitoring in 2026. China Automotive Engineering Research Institute (CAERI) and China Automotive Technology & Research Center (CATARC) and have also announced use of HBMs for consumer information starting in 2026 and 2027 respectively.

Trust in the HBM predictions is important for the inclusion and acceptance of HBMs in virtual testing. To build trust in the HBM predictions a certification framework has been developed by Euro NCAP. The framework is developed to evaluate the capability of the HBMs to predict human response in numerous load cases varying from simple pendulum impacts to complex sled tests with seat belt and airbag. The HBM predictions are compared to results from postmortem human subject (PMHS) tests and thresholds for model acceptance are defined.

By including HBMs in consumer information programs safety benefits can be expected. HBMs can address safety assessments which ATDs are not capable of. Evaluation of the robustness of the restraint system for the population of vehicle occupants is one example. The assessment of the robustness of the restraint system by means of the three available ATD sizes, small female (5F), average male (50M) and large male (95M) is limited. For robustness evaluation with HBMs a family

of models of heights, weight and sex representing the population of vehicle occupants enables a more extensive evaluation of the robustness of the protection system.

In future vehicles the occupants will have greater freedom to freely choose sitting posture. Therefore, a reclined sitting posture is expected to be more frequent. The tool used to assess the protection of the reclined occupant has to be capable of assuming a human reclined posture. The spine of the ATDs comprises a few segments limiting the range of motion and shape variability of the spine. The high level of detail of HBMs, in particular for the spine in which each vertebra is modelled individually, enables realistic human posture and motion of the spine regardless of sitting posture. This makes HBMs suitable tools for evaluation of

safety for reclined occupants. Hence, a realistic human sitting posture for the reclined posture can be achieved.

With HBMs injury can be assessed at a level of detail not possible with the ATDs. For frontal impact chest injury risk is assessed by means of global chest compression measured at one point in the chest. Limitations in discriminating between concentrated load (seat belt) and distributed load (airbag) in frontal impact with a global chest compression has been identified. With HBMs, injury risk can be evaluated with physical parameters related to the injury mechanism. E.g. rib fracture risk can be predicted by means of strain in cortical bone of the ribs enabling discrimination between concentrated and distributed load on the chest.

A smooth introduction of HBMs into virtual testing can be achieved by bridging the inclusion of HBMs with ATDs. HBMs can be used to complement the ATDs in load cases where HBMs can be expected to add value and provide a clear benefit in real world safety. The boundary condition models to be used for HBM assessment can be validated by means of ATDs. Trust in the HBM predictions is fundamental. Therefore, continued development of the validation and certification framework for the HBMs is important. Still, the HBM analysis should be as simple as possible but as complex as needed to provide robust, reliable and biofidelic predictions.

THE EVOLUTION OF BETA / CADENCE PORTFOLIO IN A NUTSHELL

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KEYWORDS –
ANSA, EPILYSIS, META, KOMVOS, SPDRM, ANSERS, FATIQ, ML, SPH, RETOMO

ABSTRACT –
Welcome to a selection of highlights, reflecting the evolution of our software portfolio. During this presentation we will walk you through the progress that our software has made and we will guide you through the respective presentations to be given during our event.

Session 2

FROM DATA TO DECISIONS: ENHANCING BIW DEVELOPMENT THROUGH ADVANCED DATA ANALYTICS

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KEYWORDS –
Data Analytics, Knowledge Graph, Development Data, Simulation

ABSTRACT –
In the development cycle of a Body-in-White (BIW), engineers conduct thousands of simulations in multiple disciplines (crash, NVH, Strength, Durability, etc.). Due to the complexity of the process and large amount of data, engineers loose track over time of valuable lessons learned and the specific measurements that effectively addressed challenges. With the rise of advanced engineering AI-powered processes, the demand for accessing and comprehending vast amounts of data has intensified. To harness the potential of previously generated simulation data, we have implemented a data analytics approach that integrates state-of-the-art reverse engineering functions and knowledge graphs. This proposed solution enables users to screen existing metadata from simulation projects, query new information across hundreds of simulation results, and reverse engineer decisions made in past projects that contributed to performance improvements. By utilizing intuitive dashboards and visualizations, the approach simplifies the navigation through complex information, empowering engineers to recover lost knowledge and enhance their decision-making capabilities.

INTEGRATED SOLUTION FOR PCBS AND ELECTRONIC DEVICE DROP TESTING

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KEYWORDS –
Droptest, PCB, Electronics, Explicit

ABSTRACT –
Drop testing is a crucial practice to ensure electronic devices can endure the bumps and falls of everyday use. The primary goal is to evaluate the device's resilience to impact shocks and identify any potential points of failure.
BETA / Cadence has been providing tools that automate the creation of finite element models of electronic devices for several years. Joining forces with Cadence enabled the enhancement of these tools, aiming to provide a comprehensive and integrated solution for the structural analysis of electronic components and devices.
Over the past year, significant efforts have been made in all phases of the process to develop the necessary tools and technologies.
In the model creation phase, automatic translation of ECAD files is followed by pre-configured meshing scenarios and load case generation templates. This allows for various modelling options depending on the intended analysis.
In the post-processing phase, automatic report templates assist analysts in effectively processing results and making appropriate design decisions.
The missing component, the explicit drop test solver, can be substituted with any of the established solvers.
Nevertheless, a new explicit solver developed by Cadence, will be available soon. The new solver is designed to enhance the drop test simulation process. This ensures that the entire analysis cycle can be completed within the BETA/Cadence environment, offering unparalleled efficiency and ease of use, thereby boosting productivity and simulation quality.
Moreover, the introduction of process and data management workflows, along with tighter integration with EDA tools, will enable the realization of the In-Design Analysis vision in the near future.

ACCELERATING AERODYNAMICS: GPU-POWERED CFD SIMULATION WORKFLOW

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KEYWORDS –
ANSA, Fidelity AutoSeal, FidelityCFD, META, CFD

ABSTRACT
The last few years have seen the rise of GPU computing applied to CFD simulations. This change of paradigm reduces simulation turnaround time by one to two orders of magnitudes, from hours to minutes. In this context, the share of the total workflow time spent in pre-processing and meshing a model is increasingly high. Having access to simple integrated tools to link pre-processing and simulation, avoiding data transfers from one platform to another becomes essential to reducing the overall turnaround time.

Discover how Fidelity CFD is now integrated within the Ansa platform to provide a seamless environment from CAD to Post-processing in Meta, allowing users to leverage a GPU-Powered CFD Simulation Workflow.

Session 3A

ADAPTIVE RESTRAINT INSIGHTS: INFLUENCE OF SEAT BELT POSITIONING ON UPPER BODY KINEMATICS USING HYBRID III AND GHBMC MODELS

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KEYWORDS -
Crash simulation, Seat belt positioning, Occupant kinematics, Adaptive restraint system

ABSTRACT
Crash simulations are a key element in modern vehicle development. They provide valuable insights into occupant motion and injury mechanisms. In this study, we investigate how seat belt positioning influences upper body rotation during a crash. We compare two occupant models: the widely used Hybrid III (H3) dummy and the anatomically detailed Global Human Body Consortium (GHBMC) model. All simulations are carried out Using the BETA-CAE software suite, with ANSA for model setup and Meta for post-processing.

EuroNCAP vision 2030 - “Safety for all”, highlights the use of adaptive restraint systems Using occupant information from interior sensing. This study is motivated by the growing use of pre-crash interior sensing systems. These systems detect the posture and position of the occupant just before a collision. Our aim is to examine how different upper body orientations, resulting from variations in belt positioning, affect occupant kinematics. This understanding will help to adapt airbag deployment strategies in the future, based on the real-time occupant position. We vary the belt anchor points and shoulder belt routing to cover realistic seating configurations and body geometries. Simulations are run with both models, and upper body motion is evaluated for each configuration. While the analysis is still ongoing, we expect to identify key belt parameters that influence motion and potential injury. The comparison between the H3 and GHBMC models should show the benefits of Using detailed human body models in crash safety studies.

This work highlights the strengths of the BETA-CAE suite in performing parametric crash studies. It also shows how simulation tools can support the move toward adaptive, intelligent restraint systems. In future work, we plan to extend the study to other body areas and crash scenarios to further improve occupant safety.

TOWARD SAFER MOTORCYCLISTS: ENHANCING HUMAN BODY MODELS BY INTEGRATING RIDER POSTURE VARIABILITY

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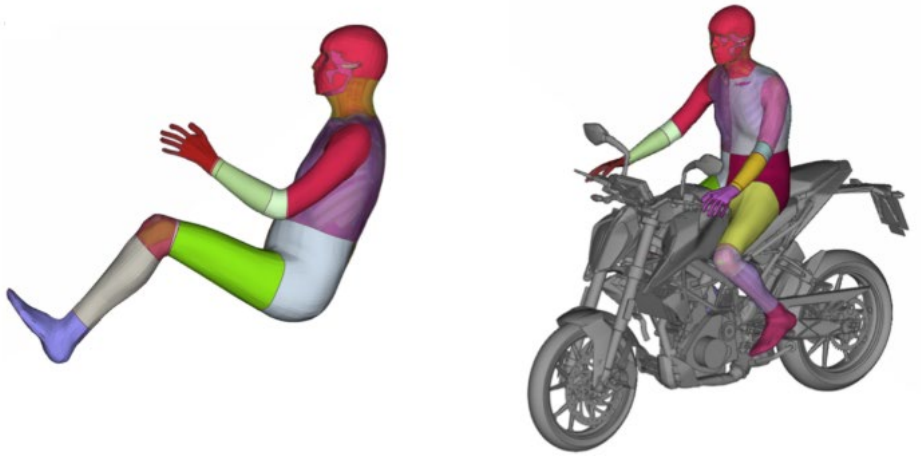
KEYWORDS -
Human Body Model (HBM), motorcycle, power two- and three-wheeler (PTW), vulnerable road user (VRU), posture

ABSTRACT –
Powered two- and three-wheelers (PTWs), such as motorcycles, account for 12% of the global motor vehicle fleet and are continuing to grow in popularity [1]. Yet, PTW riders are the most vulnerable road user group, facing a high risk of injury or fatality [1]. This highlights the need for additional countermeasures to further protect motorcycle riders in crashes.

The objective of this study is to refine a Human Body Model (HBM) for injury prediction in motorcycle crashes with a particular focus on the influence and variability of rider posture. Posture has been shown to impact injury outcomes—especially for the two most frequently injured (AIS2+) body regions: the head and chest [2-5]. Yet, posture variation is often underrepresented, and rider surrogates used in research are typically positioned in a single nominal posture [6-11].

To address this, detailed rider postures were measured for both 50th percentile male and female motorcyclists. The posture measurements were conducted by the Instituto de Biomecánica (IBV). Then, Principal Component Analysis (PCA) was applied to this data to quantify and describe full-body posture variability observed across 50th percentile male and female subpopulations. Among the most pronounced posture variations observed were anterior-posterior pelvic tilt, head pitch, and spine curvature [12-13].

A key development within the study was the ANSA HBM Landmark Positioning Tool. This tool uses the defined posture data to automatically transform and position an HBM into representative motorcycle riding postures. Utilizing the ANSA HBM Articulation Tool, the tool enables real-time configuration of biofidelic rider postures for crash simulations.



(a) (b)

Figure 1: (a) SAFER HBM in its initial occupant posture, (b) SAFER HBM positioned in a

PTW rider posture Using the ANSA HBM Landmark Positioning Tool.

In parallel, virtual PTW models were developed and compared with full-scale crash tests against rigid barrier [14]. These models, together with the latest SAFER HBM, were used to simulate diverse crash scenarios and rider postures, enabling the evaluation of innovative safety concepts including motorcycle-mounted airbags, inflatable clothing, advanced helmets, and other passive protection systems.

The outcome of the study will be a validated and versatile HBM, featuring an automated process for positioning supported HBMs in representative rider postures. This represents a foundational step toward establishing a comprehensive framework for realistic PTW safety evaluations Using HBMs. The resulting framework will support the development of robust passive safety systems and, ultimately contribute to reducing injuries and fatalities among motorcycle riders.

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HBM CONNECT® FAMILY OF HUMAN BODY MODELS INTEGRATE TO BETA CAE TECHNOLOGIES

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KEYWORDS -
HBM Connect, morphing, injury assessment, rib fracture

ABSTRACT
Human Body Models (HBMs) have emerged as one of the promising tools for evaluating occupant safety in automotive crash simulations. Various consumer protection agencies including Euro NCAP and regulatory institutions globally are introducing HBMs to the safety requirements forcing engineers to apply HBMs for virtual testing and product development.

Humanetics is developing next generation of human body models called HBM Connect aimed at virtual testing and product development applications. Humanetics and BETA CAE team working collaboratively to develop tools facilitating product development engineers with user-friendly and efficient technologies and interfaces for HBM posture control and injury assessment.

HBM Connect® models are integrated to ANSA to have the state-of-the-art articulation tool. ANSA's advanced morphing algorithm with multi-body dynamics solver allows for transformation of geometry for the HBM Connect®. It supports various movement types, such as translation, rotation, and biofidelic moves while retaining key geometrical characteristics through the use of constraints. The morphing tool offers a timesaving, real time positioning approach for the customer to articulate the HBM Connect® model to the desired posture through a user-friendly interface within ANSA. The final mesh quality is maintained, and the mesh is transitioned smoothly during the posture adjustment phase.

HBM Connect® models are integrated to META for the HBM Post tool that provides advanced injury risk predictions for different body regions including visual and quantitative results for full body or body region animations of HBM kinematics, strain contour plots depicting skeletal deformations. While the Occupant Injury Criteria tool in META computes all standardized ATD injury criteria applicable for HBM Connect®.

The current study aims to demonstrate integration of HBM Connect® in ANSA and Meta Post for two discrete applications: 1) recline seating and bicyclist postures in ANSA, and 2) kinematics and rib fractures assessment for the full-frontal load-case in META.

A PRIORI QUANTIFICATION OF CROSS-TALK IN TRIMMED ISOGEOMETRIC SHELLS VIA ADAPTIVE SAMPLING

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KEYWORDS -

ABSTRACT –
Isogeometric Analysis (IGA) [1] has emerged as a powerful computational framework that unifies Computer-Aided Design (CAD) and Finite Element Analysis (FEA) by Using spline-based basis functions directly for analysis, which also enables higher-order continuity and more accurate geometric representations. In particular, immersed geometry approaches within IGA have gained attention for their ability to handle complex trimmed geometries without requiring boundary-fitted meshing. However, this flexibility introduces new challenges, such as the cross-talk phenomenon – a numerical artifact caUsing spurious load transfer across non-material domains when certain basis functions span over non-convex support domains.

While recent versions of ANSA (v24.1.0 and later) have incorporated a preliminary cross-talk detection feature, it provides users with only qualitative visual insights. From both academic and industrial perspectives, there is a critical demand for a robust and a priori quantitative description of potential cross-talk intensity. “A priori” herein is important so that the model reliability and numerical risk can be assessed at the preprocessing stage.

In this work, we propose a novel framework for quantifying the potential of cross-talk that relies solely on the geometry and the discretization, i.e. independent of simulation results. The methodology is based on an adaptive sampling algorithm that assesses the interaction between trimmed shape functions and the topology of their support domains. This framework yields two levels of metrics: (1) a control-point-wise cross-talk intensity metric, which can serve as an adaptivity indicator for the potential numerical remedies [2, 3], and (2) a spatially interpolated cross-talk intensity field that can be visualized during the preprocessing to guide modeling decisions.

By enabling early-stage, quantitative risk assessment of cross-talk, this framework enhances the predictive reliability of immersed IGA models and supports the growing demand for automation and robustness in industrial design processes.

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Session 3B

UNLOCKING MULTIPHYSICS SIMULATIONS WITH SPH SOLVER

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KEYWORDS –
SPH, CFD, Thermal Analysis, Solver Coupling

ABSTRACT –
Smoothed Particle Hydrodynamics (SPH) has emerged as a powerful fluid simulation method applied across a wide spectrum of engineering domains, owing to its meshless nature and innate ability to tackle highly non-linear, transient phenomena—particularly in free-surface flows and unbounded domains. In recent years, the ANSA SPH Solver has undergone substantial advancements, with a strong emphasis on integrating physical models that enhance stability and extend applicability. Coupled with GPU acceleration and seamless embedding within the ANSA pre-processing environment, the solver now enables high-fidelity, computationally efficient simulations tailored for industrial-grade analysis.
This presentation will demonstrate the latest features and capabilities of the ANSA SPH Solver through a series of representative, real-world applications that span from thermal and fluid dynamics to complex fluid-structure interactions. Three case studies will be discussed in detail: (1) thermal analysis of complex transmission systems, emphasizing coupled flow-energy behaviour due to gear friction; (2) advection fluid particles due to ambient airflow and (3) fluid-structure interaction in wading channel impact scenarios, through SPH-structural solver coupling.
Throughout these examples, we will showcase the solver's ability to capture key physical effects—pressure, surface tension, viscosity, and heat transfer—while also demonstrating its growing capacity for multiphysics simulations. These enhancements underscore a major leap forward in the ANSA SPH Solver's evolution, accelerate innovation, positioning it as a robust, scalable, and user-friendly tool for modern engineering simulation challenges.

3D NUMERICAL SIMULATION OF VEHICLE WATER WADING: INVESTIGATION BASED ON SPH METHOD

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KEYWORDS –
SPH, CFD, WATER WADING, SLOSHING TANK, CONVERGENCE ANALYSIS

ABSTRACT –
The SPH (Smoothed Particle Hydrodynamics) methodology is receiving growing attention within the framework of computational fluid dynamics (CFD) as a meshless technique able to drastically reduce computational time, nowadays fundamental in industrial contexts.
The purpose of the investigation is to show how the SPH solver developed in ANSA pre-processor is capable of accurately reproducing both experimental and traditional volume of fluid simulations, as long as the model assumptions are valid. Taking into account clear advantages on computational time by the SPH method, the investigation aims to simulate complex scenarios such as the three-dimensional simulation of vehicle water wading case, that would be computationally prohibitive in an industrial context.
Water wading refers to a specific and challenging condition in which a vehicle must be able to cross a flooded roadway without compromising the functionalities of its components. This situation is particularly hazardous for all vehicle types, as water may damage electronic systems or enter the engine's air intake system (AIS).
In order to simulate this specific condition and validate results, benchmark experimental tests and traditional volume of fluid simulations are reproduced and compared to the SPH results.
Unlike the traditional VOF simulations, in the SPH approach particles are tracked in a Lagrangian framework over time.
Using a model based on the assumption of an incompressible and single-phase fluid, vehicle water wading results obtained are also supported by a convergence analysis. The analysis is based on an analogy with Richardson extrapolation, typically used to estimate the discretization error in traditional CFD simulations.

[ONLINE] CURVED MESH GENERATION FOR HIGH-ORDER SPECTRAL ELEMENT SOLVERS

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KEYWORDS –
ANSA, Hexa Block, CFD, Structured Mesh, High-Order, SOD2D

ABSTRACT –
The Continuous Galerkin high-order spectral element method (CG-SEM) is widely used to solve turbulent flow problems, particularly at very high Reynolds numbers, due to its superior accuracy in resolving small-scale features. This class of methods offers both exponential convergence and the flexibility to handle complex geometries.

In the present work, the SOD2D (Spectral high-order code to solve partial differential equations) solver is employed to simulate the flow field around a simplified car model. The geometry is based on a modified SAE body with a realistic A-pillar, adapted to capture detailed flow separation in this region. Accurate representation of curved geometries is critical in high-order SEM to preserve solution accuracy. Using straight-sided elements in curved regions introduces geometric errors that dominate the solution, regardless of the polynomial order, ultimately limiting spectral convergence. To address this, ANSA was used to generate a fully structured hexahedral mesh Using the Hexa Block tool. This approach enables fine control over mesh growth in different regions and supports mesh elevation up to fourth order, including the placement of interior nodes.

This enhanced meshing strategy was applied to the simplified car geometry. The resulting fourth-order curved mesh accurately captures the complex surface geometry, enabling the SOD2D solver to preserve spectral convergence and deliver high-fidelity results at the boundaries.

SUPERCHARGE YOUR DESIGN: LEVERAGING OPTIMALITY AND AI FOR ENHANCED AERODYNAMICS OPTIMIZATION

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KEYWORDS –

ABSTRACT
Optimization studies for aerodynamic drag reduction on automotive configuration have historically been hard to manage because of the high computational cost of each individual CFD simulation. This is because of the large meshes required by such configurations and relatively long simulation time and cost.
The advent of GPU computing and progress of meshing technologies are changing this and allowing full CFD workflow to be carried orders of magnitudes faster than before.
Optimality makes use of Ansa pre-processing and mesh generation and of GPU-powered simulation Using Fidelity to carry out optimizations for automotive aerodynamics. Designs are generated Using Ansa morphing and automatically meshed and sent to Fidelity CFD, and finally to Meta for post-processing.
While direct CFD-led optimization can be performed, Optimality can also perform AI-led optimization, making use of quasi real-time inference on every new design during the optimization process.

Session 3C

CAE DATA MANAGEMENT: STATUS OF USAGE OF SPDRM AT MODEL FACTORY. COVERAGE, EXPANSION, PERSPECTIVE FOR ITERATION

Jérémie Gomez
RENAULT Group

KEYWORDS –
Models Build-up Data Management, Expansion, Leadtime Reduction Breakthrough, Iteration

ABSTRACT –
From 2018, and first Deployment of SPDRM at Renault Group, its expansion and usage increased continuously, including successive Structure domains, specific Models and Simulation management …
After 6 years, of run Life, this session will highlight current covered scope by SPDRM management, by presenting overview and metrics.
We will also focus on some Cases deployed during these last 5 years:
• Massive Reuse Process from DM (single Mesh / Standard components)
• Digital Continuity: from BOM/PDM metadata to Parts to Mesh... process Adaptation for 3DExperience.
• Modular organization for Multi Loadcases management: Case of Hood
We will conclude with some perspectives regarding challenges we're facing to reduce our Leadtime along with continuous expansion of Simulation Validation:
SDM for Iteration management / Komvos for CAE specialist / Sprints management / Interconnection with 3DExperience and Renaulution Virtual Twin as Global Digital Backbone

LATEST DEVELOPMENTS IN SPDRM

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KEYWORDS –
Data management, process management, model building, legacy data import, Simulation Run management, HPC Submission

ABSTRACT –
This presentation provides an overview of the latest developments in SPDRM, highlighing key advacements made over the past couple of years. It is structured in two sections: The first section briefly covers the core technology updates that have enhanced the system's performance and scalability. The second and main part focuses on how recent enhancements have added tangible value to the out-of-the-box offering.

Central to these advancements was the upgrade of the primary desktop client application to KOMVOS – a pivotal step that unlocked a wide range of new capabilities. Examples will illustrate how this upgrade enabled greater modularity and improved the user experience through more streamlined workflows across simulation teams.

REDEFINING SIMULATION TEAMS: EMPOWERING ENGINEERS WITH DEDICATED PROCESS AUTOMATION EXPERTS

Wojciech Rzadkosz
EVCON

KEYWORDS –
digital transformation, automation, CAE, process, integration.

ABSTRACT –
Traditional simulation teams, composed of CAE engineers, are under increasing pressure to deliver high-quality results faster and more consistently within ever-tightening vehicle development timelines. Yet these teams often face a familiar constraint: skilled engineers spending a disproportionate amount of time on manual, repetitive tasks. From model setup and variant updates to batch runs and report generation, such work reduces engineering focus and increases the risk of inconsistency.

This presentation introduces a new paradigm: embedding a Process Automation Expert (PAE) directly within each CAE team. A PAE combines domain understanding with programming and workflow design skills, enabling the automation of routine processes and the development of robust, reusable toolchains that empower simulation engineers to concentrate on high-value problem-solving.

Using practical examples from vehicle programs, I will demonstrate how CAE teams supported by PAEs:

· Deliver results more consistently and with fewer errors,

· Scale their output more easily under time pressure,

· And improve collaboration across simulation, design, and testing functions.

We will also highlight how this model leverages the strengths of modern CAE tools — in particular, Cadence - BetaCAE software, which offers highly customizable, well-documented APIs and scripting capabilities. These tools make it feasible to embed automation deeply and flexibly, without disrupting existing engineering workflows or compromising traceability.

Attendees will leave with a clear understanding of how to introduce the PAE role into their own organizations, the skills it requires, and the strategic value it brings. Ultimately, this talk argues that to meet today's simulation demands, CAE teams must evolve — and the Process Automation Expert is central to that evolution.

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TOWARDS ZERO-MESHING EFFORT AT BMW: INNOVATIONS IN DCM & ANSA

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KEYWORDS –
DCM, Midsurfacing, Pressed Elements, Casting meshing

ABSTRACT –
In the context of BMW's complex and variant-rich product development cycle, this paper highlights critical challenges in the meshing pipeline. The meshing process in particular for shell parts has already known high levels of automation and mesh quality.

Nevertheless, still a fluctuating amount of parts is failing in terms being successfully batch meshed, something that is strongly connected to bad CAD-conversion quality at times, complex geometry features such as tailor blanks or the existence of pressed elements merged geometrically with the main body. At the same time as shown in previous work, the reuse of legacy FE-mesh data presents a critical opportunity for efficiency gains related especially to the parts categorized as Casting parts: aluminum or injection moulding kind of components.

While Inherit Meshing technology offers re-usability of mesh data across unchanged regions between design revisions, its real-world applicability is hampered by inconsistencies in data organization, mesh attribution, and versioning fidelity.

Finally new challenges arise to increase meshing efficiency for further part types, such as cable-like or sealing geometries. Addressing all these through algorithmic mesh reuse, metadata standardization, and continuous tooling updates positions this work as a cornerstone in evolving digital engineering strategies for OEMs navigating high-variance design environments.

Session 3D

MULTIMODAL CHARACTERIZATION OF POLYMERIC FOAM BASED ON X-RAY COMPUTED TOMOGRAPHY AND DIGITAL VOLUME CORRELATION

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KEYWORDS –
Cellular Solid, Microstructure Characterization, Foam Tool, Digital Volume Correlation (DVC), Representative Volume Element (RVE)

ABSTRACT –
Cellular materials, particularly polymeric foams, offer beneficial mechanical, thermal, and acoustic properties that make them valuable for various engineering applications. Understanding the relationship between the foam's microstructure and its macroscopic mechanical behavior is crucial for optimizing the material design and performance. This research project aims to provide a comprehensive characterization of polymeric foam microstructure and its influence on the material's tensile response.
The study involves scanning foam samples with varying densities Using ex-situ X-ray computed tomography imaging. The initial microstructure is analyzed Using the Retomo foam tool, which provides information about pore size, shape, distribution, and orientation. From the same image data, triangular surface mesh of the segmented solid phase is created to extract a finite element model.
On basis of the image data several finite element models, including a representative volume element generator that processes statistical microstructure data, are created. Tensile loading simulations are performed on these models to investigate the material's response.
In a second step, the foam specimens are scanned under tensile loading, and the resulting computed tomography images are analyzed Using digital volume correlation to obtain the strain fields within the microstructure. These experimentally derived strain data are then used to calibrate the material model for the solid matrix phase of the foam.
The key outcomes of this research include the comprehensive characterization of the foam microstructure, the development of image-based finite element models, and the calibration of the matrix material model Using digital volume correlation strain measurements. This approach provides valuable insights into the relationship between the foam's internal structure and its macroscopic mechanical behavior, which can contribute to the design and optimization of cellular materials for various engineering applications.

MICROMECHANICAL MODELING OF CLOSED-CELL FOAMS BASED ON COMPUTED TOMOGRAPHY DATA

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KEYWORDS –
Closed-cell foams, Computer tomography, Representative volume element, Laguerre tessellation, Shell

ABSTRACT –
Closed-cell foams are widely utilized in modern engineering applications due to their appealing specific mechanical properties with respect to low density. Given the exploitation of closed-cell foams for load-bearing purposes, the compressive behaviour is often of interest. To gain in-depth understanding of the deformation and failure mechanisms under compression, a micromechanical modeling framework of closed-cell foams Using shell elements based on computed tomography data is developed in this contribution. Divinycell foam H100 is focused on as one example. Computed tomography (CT) scan is conducted on foam samples to characterize the three-dimensional (3D) mesostructures, which are further post-processed in RETOMO to determine the stochastic variations of cell size, cell wall thickness and cell shape anisotropy. Based on the measured mesostructural stochastics, representative volume elements (RVE) of foam mesostructures are generated Using Laguerre tessellation techniques. RVE models are discretized Using geometrically nonlinear shell elements. The base material behaviour is described Using a stress resultantbased isotropic elastoplastic model. Uniaxial compressive loadings in different global directions are applied.
The probability density functions of cell size, cell wall thickness and cell shape anisotropy determined Using RETOMO are found to be comparable with those reported in the literature. The compressive stress-strain responses and mechanical properties predicted by the tessellation-based models demonstrate an excellent agreement with the experimental results. Moreover, quantitative analysis of the cell wall deformation behavior shows that the cell wall membrane deformation dominates the initial elastic region and the cell wall elastic buckling acts as the leading failure mode for the considered foam grade

INTEGRATIVE SIMULATION OF AL-LPDC AND AL-HPDC – FROM EXPERIMENT TO MAPPING OF PROCESS PARAMETERS

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KEYWORDS –
aluminium cast alloys, low pressure die casting, high pressure die casting, process simulation, crash simulation

ABSTRACT
The trend of bigger aluminum die casting components entails a bigger range of material parameters which poses a challenge for virtual design. Substituting multiple smaller sheet steel components and their common joining techniques by a large HPDC component allows to reduce the overall weight and production cost of the assembly. However, the drawback of growing components, also often referred to as megacasting – is to account for the stronger variation of material properties which increases with the size of the component. A systematic material characterization for the material model MF GenYld+CrachFEM developed by MATFEM for crashworthiness simulation is presented for both aluminum low pressure die cast (Al-LPDC) and aluminum high pressure die cast (Al-HPDC) applications. Based on a comprehensive material characterization material cards are derived. Furthermore, the systematic scatter induced from the process is integrated and secondly an unsystematic scatter inherent to the process/material is accounted for. The systematic scatter is integrated by empirical equations which correlate the mechanical properties such as yield strength and ductility – equivalent plastic strain at fracture as a function of stress state - with process parameters cast length and local solidification time. In addition, the non-systematic variation of properties observed in experiments in every location is integrated in the simulation run with a probabilistic seeding.
The suggested modeling technique is not only validated on coupon level with examples from industry and academia, but an outlook is given of an integrative simulation workflow to map the process parameters onto a structural simulation on component level. In this workflow the results from the process simulation in MAGMASoft are exported to an auxiliary file via MAGMAlink and mapped onto a LS-Dyna crash mesh Using ANSA. In the simulation run MF GenYld+CrachFEM interprets the process history and scales the mechanical properties for each integration point individually.

[ONLINE] MODELLING OF BIOCOMPOSITES IN CRASH APPLICATIONS

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KEYWORDS –
CT Scan, Natural Fiber Composites, Fiber Orientation Analysis, Homogenization

ABSTRACT –
Biobased materials and biocomposites are essential in achieving climate neutrality in many industries. Biobased materials capture carbon dioxide during their growth phase, and the use of these materials in components does not release new CO_2 into the atmosphere in the same way fossil-based materials do. Furthermore, these materials are renewable, leaving resources for future generations. Biobased fibers used in biocomposites often exhibit good mechanical properties and can offer weight savings compared to traditional plastics or fiberglass composites. This further enhances their positive climate impact by reducing carbon dioxide emissions during the usage phase.
Increased use of biocomposites also necessitates a better understanding of their mechanical behavior and the ability to model them with CAE (Computer Aided Engineering) tools. From being used in hidden and non-structural applications, biocomposites are now being explored for visible surfaces (A-surface) and structural parts. These types of components play a crucial role in designing passenger safety features, such as triggering airbags, or in the long term, in structural crash safety. CAE tools are widely used to ensure specific design of safety features and depend on advanced FE (Finite Element) models and material models. However, such models are currently lacking for biocomposites. One reason for the lack of models is the complex microstructure of these materials. Natural fibers, such as flax or kenaf, have a hollow and irregular shape, resulting from how they are grown. Additionally, many materials are developed in the form of a mat that is preheated before being compressed. In the mat, natural fibers are mixed with polymer fibers that serve as the matrix when melted. The level of compression relative to the amount of fibers and geometry results in a varying number of pores formed. On a macro level, these materials exhibit anisotropic behavior, which, depending on the matrix material used, is strongly temperature- and deformation-rate dependent.
This paper presents a new method for creating material models based on virtual testing of FE models derived from high-resolution (HR) image analysis. Through high-resolution images, such as from computed tomography, details of the complex microstructure can be revealed and modeled. Numerical homogenization of the modeled microstructure is subsequently performed and the final homogenized response used in CAE analysis. The paper also investigates the variations introduced in properties by the microstructures and how this can be accounted for in complete car analysis.

Session 4

STANDARDIZING SIMULATION AT DAIMLER TRUCK: A CROSS-DISCIPLINARY SHIFT FROM LEGACY TOOLS TO A FUTURE PROOF PLATFORM

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KEYWORDS –
Model building, Simulation Run Management, SPDRM, ANSA, META, MIDAS

ABSTRACT –
Daimler Truck is the world's largest commercial vehicle manufacturer, operating a global network of R&D centers. The simulation landscape at Daimler Truck has long been shaped by domain-specific requirements, resulting in a variety of tools used for model preparation and results analysis. This diversity presented both strengths and challenges, particularly in scaling and standardizing practices, as well as sharing work among different teams. Simulation Data Management was an unfamiliar concept to many, with only a few teams leveraging commercial solutions for systematic data handling.
A major shift began when the CAE steering committee at Daimler Truck selected SPDRM as the company-wide solution for Simulation Process and Data Management. This decision unlocked a range of opportunities:
• Global data sharing and reuse across R&D locations
• Consistent storage of simulation artifacts, from parts to assemblies, simulation results and reports
• Fully automated, part-level model processing, with direct integration to the PDM system
• Harmonized model building workflows across engineering disciplines
• Standardized and automated daily simulation tasks
• The foundation of a well-structured, labelled, data repository for Machine Learning initiatives
This presentation will showcase how the new simulation platform is driving standardization across disciplines. Key use-cases will be presented, including a) Part-based processing with direct link to the PDM system, b) Model configuration strategies for managing large variant spaces, c) Simulation run management for crash simulations and d) Automated post-processing and results management for crash simulations

NEXT-GEN USER EXPERIENCE: A PARADIGM SHIFT

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KEYWORDS –
Interface, Productivity, Usability, UI, UX

ABSTRACT –
Version 25 introduced a comprehensive redesign of the ANSA and META interfaces, focused on significantly enhancing usability and productivity. Central to this update is the adoption of a ribbon-based interface, replacing traditional toolbars and modules with a more structured and visually intuitive layout. Context-sensitive ribbon tabs dynamically present the most relevant tools based on the user's current task, streamlining workflows and minimizing visual clutter.

This presentation outlines the core enhancements, including the ribbon architecture, contextual tab behavior, and improved command organization. These changes enable more intuitive interactions, reduce the number of steps required for complex operations, and facilitate seamless navigation between pre- and post-processing environments. Additionally, the interface now supports a customizable workspace, allowing users to tailor their environment to specific workflows and personal preferences.

Overall, the v25 update marks a significant evolution in the ANSA and META user experience. By embracing modern design principles and reimagining the interface from the ground up, this release delivers a more dynamic, flexible, and user-centric platform that empowers users and boosts overall efficiency.

Session 5A

DEVELOPMENT OF AUTOMATIC PROCEDURE FOR IMPORT, MESHING AND CFD SIMULATION FOR PRODUCTION OF EXTENSIVE TRAINING DATA SET FOR MACHINE LEARNING MODEL

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[1]RINA - CSM, Castel Romano

KEYWORDS –
ANSA, CFD, openFoam, Machine Learning, Python, automatic mesh

ABSTRACT –

At the beginning of 2025, a new initiative was launched at CSM to develop in-house machine learning models in support of CFD simulations. Machine learning is important for accelerating the initial design phases, where geometries can be optimized and multiple configurations of aerodynamic surfaces can be investigated. It is well known that the results of machine learning depend on the datasets used for training.
In this work, we focused on building a large and robust dataset. Using a script, more than 1,600 airfoil profiles were collected from AirfoilTools(1). Through Python code, data cleaning a data reordering were performed and, subsequently, the profile points were imported into ANSA to build a circular domain and an O-type structured mesh.
To obtain the O-type mesh, the trailing edge of each profile has been modified from having a pointed shape to having a rounded shape in order to achieve high quality of the elements surrounding the profile.
After this process, the mesh was exported from ANSA and imported into OpenFOAM, where it was combined with an external domain containing preset boundary conditions. After the simulations, the data were exported and delivered to machine learning stage to train the model.

REFERENCES

1. Airfoil Tools. (n.d.). Airfoil database search

MULTI-OBJECTIVE AERODYNAMIC OPTIMIZATION OF AIRCRAFT – A COMPARISON BETWEEN GEOMETRY PARAMETERIZATION AND MESH MORPHING APPROACHES

Giuseppe Porpiglia
Leonardo Spa

KEYWORDS –
Aerodynamics, CFD, Optimization, Methodology

ABSTRACT –
In this work, we present a methodological approach for the aerodynamic shape optimization of an aircraft wing, developed over the past months. Three distinct optimization/morphing strategies were investigated and compared, with the overall process managed through a ModeFRONTIER-based pipeline. The workflow integrated several specialized tools, among which ANSA and CFD++ played a central role. Particular emphasis is placed on the role of ANSA, which was used to develop an advanced morphing setup. The mesh morphing capabilities of ANSA allowed for the creation of a flexible and parametric environment, enabling the efficient exploration of the design space. This integration highlights the potential of combining powerful pre-processing and optimization tools within a streamlined workflow to tackle complex aerodynamic design challenges.

BE(Y)OND SIMULATION: A CFD WORKFLOW VALIDATION FOR A KART AEROKIT WITH ANSA, FIDELITY CFD AND META

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KEYWORDS –
ANSA, META, Fidelity, CFD, Aerodynamics, Wind Tunnel

ABSTRACT –
The aerodynamic development of racing components increasingly relies on virtual validation workflows to reduce physical testing and accelerate design iterations. This work presents a comprehensive CFD workflow applied to the analysis and validation of an aerokit designed by our team for a kart racing application. The component, developed by BEOND, produced by KG Kart and homologated in 2020 by the FIA, was adopted in the Karting World Championship by top-tier categories such as KZ. Featuring an internal duct to manage airflow and reduce drag, the KG508 aerokit represents an advanced and challenging use case for simulation-based aerodynamic optimization.

The development process followed a phased evolution from a legacy version, KG506, through an intermediate design KG507, to the final model, KG508. The validation strategy was based on two key correlation steps: (i) a numerical-experimental comparison of relative aerodynamic performance between the KG507 and KG508 kits without a driver model, and (ii) an absolute performance validation for the KG508 configuration including a driver. While the original design was carried out in another software, this work reproduces those steps Using ANSA, Fidelity CFD, and META.

This approach enabled an assessment of both the accuracy of the solution and the consistency and efficiency of the adopted workflow across tools and data sources, and highlighted how an integrated CFD environment Using ANSA, Fidelity CFD and META can streamline the virtual validation process, improve consistency across tools, and support informed decision-making during the aerodynamic design phase of competitive, high-performance applications such as karting.

COMPARATIVE ANALYSIS OF OIL DISTRIBUTION ON ELECTRIC MOTOR SHAFT BEARINGS USING SPH AND CFD METHODOLOGIES

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KEYWORDS –
Multiphysics Analysis, Coupling CFD-SPH, Lubrification, CFD, VOF, RBM, ePowertrain

ABSTRACT –
The efficient lubrication of electric motor shaft bearings is critical for minimizing wear and ensuring operational reliability. This study presents a comparative analysis of oil wetting distribution on bearing elements Using different numerical methodologies: Smoothed Particle Hydrodynamics (SPH), Computational Fluid Dynamics (CFD), and a coupled CFD-SPH approach. The simulations were conducted Using ANSA-SPH for Lagrangian particle-based modeling and OpenFOAM for CFD multiphase flow analysis.

Three modeling strategies were employed: (i) SPH single-phase oil flow simulation, (ii) CFD-based multiphase modeling, and (iii) a hybrid approach coupling CFD-computed air velocity field with SPH oil distribution. Each method was evaluated in terms of wetting coverage accuracy, computational complexity, and simulation efficiency.

The results highlight the strengths and limitations of each approach, revealing significant differences in predicted oil behavior and wetting of bearing components. While CFD provides detailed multiphase interactions, it is computationally intensive and sensitive to mesh resolution. In contrast, SPH offers robust handling of free-surface flows and dynamic interfaces, but with limitations in capturing air interaction. The coupled methodology presents a balanced compromise, enhancing realism without the full computational burden of a fully resolved multiphase CFD simulation.

This study provides valuable insights for selecting appropriate modeling strategies for bearing lubrication analysis, especially in early design stages where trade-offs between accuracy and efficiency are crucial.

Session 5B

LATEST AND FUTURE DEVELOPMENTS IN ANSA/ASERIS-BETM FOR ELECTROMAGNETIC SIMULATIONS

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KEYWORDS – BEM, Surface Mesh, H-matrix, FMM, EMC

ABSTRACT –
ASERIS-BETM is a simulation software developed by Airbus and IMACS dedicated to Electromagnetics based on the resolution of Boundary Integral Equations (BIE) derived from Maxwell's equations in the frequency domain. It is used for a wide variety of industrial applications such as antenna design, antenna siting, Electromagnetic Compatibility (EMC) applications, Lightning Indirect Effects (LIE) or High-Intensity Radiated Fields (HIRF)…
In this presentation, we will unveil the latest advancements in ANSA and ASERIS-BETM, designed to enhance user experience and functionality. ASERIS-BETM has been originally interfaced with ANSA as a Plug-in. Since version 2025, it is accessible as the Electromagnetics Ribbon, offering a more intuitive and user-friendly experience. After an overview of the software capabilities and performances, we will focus on some advanced features such as antenna siting and Huygens box integration on a platform, and post-processing capabilities Using META. Application-specific post-processing is traditionally handled through custom in-house scripts. In upcoming releases, we will introduce a dedicated Python library that offers a comprehensive set of commonly used primitives, designed to streamline workflows and significantly boost efficiency. Using a parametric study as a representative use case, we will demonstrate the powerful new capabilities currently under development—features that are set to elevate the performance and flexibility of EMC simulations.

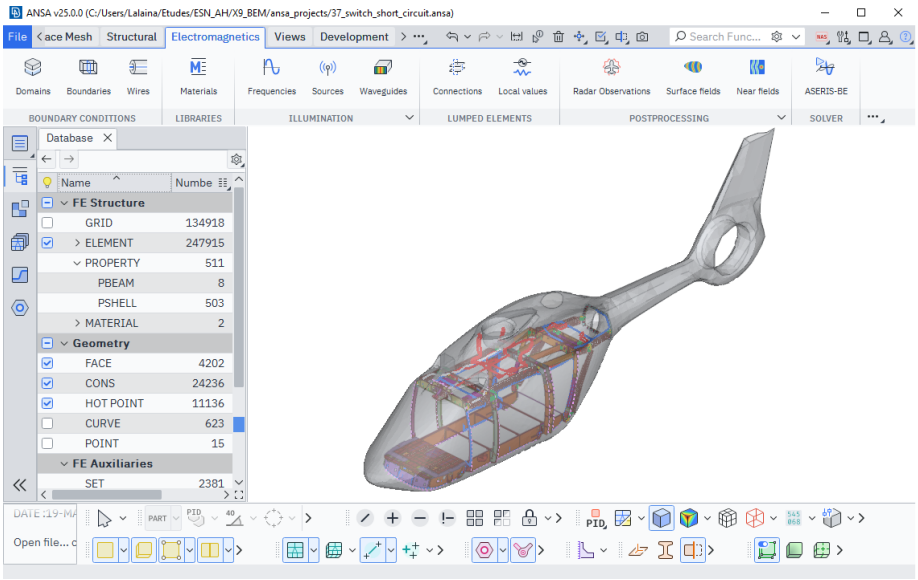

Figure 1 – ASERIS-BE™ in Electromagnetics Ribbon.

FIDELITY 3D-IC THERMAL AND MECHANICAL ANALYSIS USING ANSA HEX-DOMINATED MESH IN CELSIUS STUDIO

[2]Pavlos Floratos*, [2]Th. Kartalis Kaounis, [1]Nathan Ai, [1]Jun Lu, [2]Li Lu
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KEYWORDS –
3D-IC Packaging, High-Bandwidth Memory (HBM), Thermo-Mechanical Simulation, Warpage and Stress Analysis, ANSA automated re-meshing

ABSTRACT –
High-performance computing increasingly relies on 3D-IC packaging technology, which allows high-bandwidth memory (HBM) to be placed or stacked in close proximity to CPUs and GPUs. This architecture maximizes data transfer rates, minimizes power consumption, and reduces the overall form factor. A typical 3DIC (or 2.5D) configuration consists of a stacked silicon interposer, system-on-chips (SoCs), HBMs, and an organic substrate, all connected by hundreds of thousands to millions of solder and/or bump interconnects. These dense and complex structures present significant challenges in capability, performance and accuracy for conventional thermal and mechanical simulation tools.
To address these challenges, Celsius Studio has introduced a fully automated 3D-IC simulation platform that integrates ANSA's 2D meshing technology with Cadence's layer-based 2.5D mechanical module for thermo-mechanical analysis. This tool supports global-level meshing for major components as well as sub-model meshing for detailed features such as micron and C4 bumps. Users can control the granularity of the mesh in both planar and vertical directions. Warpage simulations are conducted at the global level, while stress analysis utilizes both global and sub-model approaches. Notably, a bump stress index is introduced, providing designers with a detailed visualization of stress distribution across layers and locations, particularly at micron bumps. This paper also discusses future directions, including bump reliability assessment and optimization, along with the integration of additional 2.5D package components.

ELECTRONICS & POWER ELECTRONICS PRE/POST PROCESSING WITH BETA CAE TOOLS

Athanasios Tzanakis,
BETA / Cadence, Greece

KEYWORDS –
Power electronics, electronics, PCB, CFD, CHT

ABSTRACT –
Power electronics within inverters play a key role in the automotive industry's transformation towards the zero-emission goal. By increasing their efficiency and reducing their size, they offer a higher range for battery electric vehicles and more packaging options. However, the downside of these design changes in power electronics results in a considerable amount of heat, which needs to be continuously dissipated to guarantee a hassle-free propulsion system and increase longevity of inverter's PCBs. The power module is in contact with at least one heatsink, which is responsible for keeping semiconductors within their thermal requirements limits, while a tiny fraction of the heat is dissipated to the air via natural convection. All these phenomena could be accurately simulated by utilizing the capabilities of Conjugate Heat Transfer (CHT) modelling, a discipline of Computational Fluid Dynamics.
The coexistence of fluids and solids in a simulation requires valid interfaces which efficiently transfer the heat fluxes across the different domains. Even if it is challenging, the generation of conformal interfaces is suggested since it ensures contact existence and node-to-node matching, minimizing numerical errors. Furthermore, the accurate domain discretization with effective and robust mesh generators enhances further the simulation stability, speed and fidelity.
BETA / Cadence, with its advanced preprocessor ANSA, enables engineers to easily create contacts between different parts and domains, resulting in the desired conformal interfaces. Additionally, the continuous development of versatile mesh generation algorithms has led to the creation of a powerful new mesh generator for thin solids and narrow fluid passages - features commonly found within a traction inverter. Moreover, the five levels of PCB discretization allow high-fidelity thermal analysis regardless of the PCB design phase. Furthermore, engineers can benefit from classic mesh algorithms, such as HexaInterior, for accelerating the numerical solution.

FULL VEHICLE ELECTROMAGNETIC SIMULATION WITH ANSA AND CLARITY

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KEYWORDS –
EMC/EMI Electromagnetic Simulation

ABSTRACT –
As modern vehicles integrate increasingly complex electronic systems, ensuring electromagnetic compatibility (EMC) and performance has become a critical aspect of automotive design.

This presentation explores a workflow for full vehicle electromagnetic simulation Using ANSA for pre-processing and Clarity for high-fidelity electromagnetic analysis. We demonstrate how ANSA's advanced meshing and model preparation capabilities streamline the setup of large-scale simulation models, while Clarity's cutting-edge solver technology enables accurate prediction of electromagnetic behaviour across a wide frequency spectrum.

Session 5C

ODF&ODS – A COMPREHENSIVE APPROACH TO EVALUATE THE VEHICLE STIFFNESS USING MBD

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[1]Zeekr Tech AB / CAE Solidity & RLD, [2]BETA / Cadence, [3]BETA CAE Nordic AB, [4]AFRY, [5]Marberg Engineering AB

KEYWORDS –
Complete vehicle simulation, vehicle body stiffness, Multi Body Dynamics MBD, Multi Stethoscope MSS, Opening Distortion Fingerprint ODF, Operational Deflection Shape ODS

ABSTRACT –
The complete vehicle simulation Using Multi Body Dynamics (MBD) offers a wide range of complex load cases for both Durability and Solidity. Some of these load cases are either very hard or not possible to simulate by only Using FEM. By increasing the complexity of the flexible models (mnf), e.g. the trimmed body, the response of the body can be evaluated directly based on the MBD results.
The MBD simulation is also closest to the real test scenario when it comes to correlation between test and simulation.
The Multi Stethoscope (MSS) is used for evaluating the body response, where the acceleration is calculated at a number of different body locations. The acceleration is then evaluated in both the existing ODF (Opening Distortion Fingerprint) tool and the new ODS (Operational Deflection Shape) tool in Meta.
In order to enable an efficient simulation and test procedure, the MSS output has to be processed before evaluating it in the ODF and ODS toolbar. For this purpose, an ODF&ODS preparation toolbar has been implemented.
The first part of this presentation shows a deeper insight into the capabilities of the full vehicle MBD simulation regarding both the vehicle representation itself and the available load cases. The second part shows how the static and dynamic vehicle body response can be assessed by Using the ODF and ODS toolbar in Meta. A special focus will be on the new ODS toolbar.

FATIGUE LIFE ANALYSIS AS PART OF THE DESIGN OPTIMIZATION PROCESS FOR WELDED STRUCTURES

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BETA / Cadence, Greece

KEYWORDS –
Fatigue, damage, optimization, kinetics

ABSTRACT –
Product design in the automotive industry is increasingly demanding, requiring high performance under tight development cycles. Engineering simulation, particularly FEA, plays a crucial role by reducing the need for costly physical tests and accelerating development. Optimization techniques are now integral to the design process. Fatigue analysis is essential for predicting product life and avoiding overdesign, especially in welded structures where fatigue failure often occurs.

It is commonly integrated into optimization workflows to enhance structural efficiency. This case study examines a car subframe under cyclic loading, with forces derived from a 10-second kinematic simulation of the vehicle on a Belgian block road.

A Multi Body Dynamics solver computes the full assembly's dynamics, treating the subframe as a flexible body. Design variables are assigned to the FE model to control shape and properties. High-stress regions are targeted for reinforcement, while non-critical areas are optimized for weight reduction. Seam-weld lengths are also parameterized.

The optimization proceeds in three phases: a Design of Experiments (DOE) assesses design variables' impact, followed by training a Response Surface Model Using the Kriging algorithm, and concluding with optimization via Simulated Annealing.

INTRODUCING SUPERELEMENT TECHNIQUE FOR WELD FATIGUE ANALYSIS

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KEYWORDS –
Seamwelds, Spotwelds, Superelements, Fatigue

ABSTRACT –
Weld cracks play a significant role to fatigue failure, making the accurate modelling of both spot welds and seam welds crucial for structural durability. In the automotive industry, various methods, such as force-based and nominal stress approaches, are recommended by international guidelines for assessing the fatigue life of welded components. However, directly incorporating local stress provides more accurate results.
The key geometrical parameters of welds are the notch radius at the weld toe and root, along with the penetration depth at the weld root. Accurately simulating the geometric notch requires extremely fine meshes to capture local stress, which can result in considerable computational demands.

To tackle this challenge, the superelement approach is introduced. In finite element analysis, the superelement method simplifies and accelerates the evaluation of complex structures by dividing them into smaller, manageable components called superelements. Each superelement is treated as an independent substructure with its behaviour condensed into a reduced set of equations. In this case, each spot or seam weld is represented as a separate superelement.

The study outlines the process of generating superelements to represent welds, accurately positioning them within the complete assembly, recovering stress components at the notch and calculating at the end fatigue life. For various types of seam welds, such as overlap, Y-joint, laser, butt and corner welds, precise placement along the weld line is particularly challenging and requires special attention. A constant weld radius is applied and von-Mises equivalent stress is used as the fatigue criterion.

This work involves the comprehensive analysis of components with welds, providing a thorough and detailed description of the entire process and the challenges faced. It includes comparisons of stress results between superelement welds and those modelled with detailed geometry, aiming to critically evaluate the methodology and emphasize its significant practical benefit.

LATEST DEVELOPMENTS IN ANSA/META FOR DURABILITY SIMULATIONS AND STRUCTURES MADE OF COMPOSITE MATERIALS

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BETA / Cadence, Greece

KEYWORDS –
cross section, seamweld, bolt, oilcanning, RVE

ABSTRACT –
v25 is a new concept version for Analysis tools, including durability and composites domains. Dedicated ribbon tabs have been introduced for both domains, as well as another one for cross section by organizing the relative functionality for an easy way of their identification. Among others, the ribbons have been constructed in a workflow manner, keeping the minimum number of buttons for the main processes and features. Furthermore, the domains have been enhanced with new developments regarding:
• Seam welds with the new approach to cover all shell – solid representation types into one with more capabilities, like multiple HAZs and cross seamwelds handling
• Reduced representation of shell structures with beams through advanced automated tools
• Results mapping directly from solver files
• Toolkit for oilcanning loadcase to minimize the number of iterations and accelerate the pre- and post-processing
• Streamlined manipulation of Abaqus contacts by visualizing their status
• Stepwise wizard to define Abaqus cracks
• Support of Eurocode 3 standard for the bolt assessment tool
• New foam type in RVE modelling
• Refactor the old composite post toolbar with a ribbon tab consisting of standalone buttons for each function.

Session 5D

BODY IN WHITE SHAPE OPTIMIZATION FOR TORSIONAL STIFFNESS

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KEYWORDS –
Optimization, Machine Learning, Body in White stiffness.

ABSTRACT –
Torsional stiffness and torsional angle are among the most important key values in a vehicle's Body in White (BiW) development. These two values along with the first torsional stiffness mode, describe the rigidity of the vehicles body and determine its behavior concerning handling, NVH, and the basis on which the suspension components will be designed upon. Control over these values is key for further control of the vehicle's comfort and handling.
During development of a BiW, multiple modifications may occur in the early stages of design, such as part thickness changes, part geometry changes, connections positions etc. Modifications of this nature would require CAD redesign and pre-processing, in order to create a new Simulation model, and analysis re-runs, to extract and evaluate the response changes.
This time-consuming process can occur multiple times during product development. In order to speed up this process, predictive models can be created to predict desired key values based on such modifications. This way the identification of important values like torsional stiffness and angle can be predicted Using a trained Machine Learning model in a fraction of the time needed for the redesign and re analysis process.
Such functionality enables multiple "what if" studies without the expense in analysis and design time.
Well trained Machine Learning models with good accuracy can replace the Finite Element Analysis and predict the results in a fraction of the solution time. This way Optimization studies become much more approachable, since they can be done assisted by Machine Learning. As a result, we get faster optimization and more optimization studies.
These methodologies have been implemented by OEM companies such as SEAT S.A., with their internally developed ARCO, the Advanced Real-time Car-body Optimization that is a physics-informed ML technique for improving car-body structure NVH behaviour. ARCO is an innovative methodology to assess the noise and vibration (NVH) performance of car-body structures. Employing this methodology allows engineers to navigate the design space more efficiently, enabling early-stage decision-making and minimizing the risk of encountering design challenges in later stages.
A current challenge is to scale up the methodology to real industrial models and allow an easy interaction of ARCO with standard commercial software. To that end an ongoing collaboration with BETA / Cadence software (ANSA and KOMVOS modules) is presented, such that a user-friendly frontend interface can be used by engineers in daily activities.

MULTI-OBJECTIVE OPTIMIZATION OF BUCKLING AND BURST PRESSURE IN COMPOSITE HYDROGEN STORAGE TANKS FOR DEEP-SEA APPLICATIONS

Dr. Mariam Jaber
King Fahd University of Petroleum and Minerals

KEYWORDS –
Composite Materials, Multi-Objective Optimization

ABSTRACT –
The development of high-performance hydrogen storage systems is critical for enabling clean energy solutions in extreme environments such as deep-sea applications. This study presents a multi-objective optimization framework to enhance the structural performance of composite hydrogen storage tanks subjected to both internal and external pressures. The primary objectives are to maximize burst pressure capacity while ensuring resistance to buckling failure under deep-sea conditions. Advanced finite element simulations are employed to evaluate the structural behavior of egg-shaped composite tanks, which offer unique advantages in stress distribution and underwater hydrodynamic performance. The optimization process utilizes multi-objective particle swarm optimization (MOPSO) to identify optimal laminate stacking sequences that balance structural integrity and weight efficiency.

[DEMO] ANSA FOR DOE AND OPTIMIZATION

Kostantinos Rachoutis
BETA / Cadence, Greece

KEYWORDS -
Optimization, Design Exploration, DOE, Parametric Machine Learning

ABSTRACT -
This demonstration highlights the comprehensive capabilities of ANSA's Optimization Tool, a powerful solution for optimization applications within CAE. The session will walk participants through the complete optimization workflow, seamlessly integrating ANSA's pre-processing capabilities, supported solvers, META post-processing, to perform efficient Design Exploration and Optimization.

Key features of the tool include its ability to massively parametrize ANSA model values and optimize model shapes Using ANSA Morphing functionalities and effortlessly calculate Key Performance Indicators of the model.

The demonstration will also cover the setup of Design of Experiment (DOE) studies, monitoring and post-processing of Experiment data, and their use in training of Response Surface Models through various surrogate model algorithms to accelerate Optimization studies.

Additionally, key functionalities of Data Management and Machine Learning methods for Simulation Results Prediction will be explored to enhance DOE and Optimization processes. By the end of this session, participants will gain a robust understanding of how ANSA’s Optimization Tool can drive more efficient and informed design decisions, significantly improving the optimization process across a wide range of CAE applications.

Session 6A

LATEST DEVELOPMENTS IN MACHINE LEARNING AND AI

Dimitris Drougkas
BETA / Cadence, Greece

KEYWORDS
Machine Learning, AI, Simulation Results Prediction, ML Classification

ABSTRACT
In the past few years Machine Learning tools were introduced, that would reduce manual effort in modelling with clips and fasteners detection and predict of simulation results thus reducing optimization time by as much as 80%. Now machine learning is aiming to be more interactive by having AI-Assistants built in our software, provide solutions and strategies for meshing and reduce the time and effort for building the Virtual Prototype in certain CFD applications.
This presentation highlights:
• The latest developments for the AI assistant that will now be integrated in ANSA and META for a much more interactive way of operating the software.
• A preview of a new Machine Learning functionality for the prediction of flow field results in ANSA for a more interactive way of understanding cause and effect on the external aero.
• A Machine Learning Part classifier for CAD and CAE data, helping in identifying the part's manufacturing type and other attributes.
• A new method of Using KOMVOS to handle custom Mode Classifiers.
• New data analysis tools on existing data, to review the impact of design decisions.
• Enhancements for Clips handling and matching, with improved clip recognition with better tolerances, automated clips matching and mesh generation for similar/ matched clips.

OPTIMIZATION AND SENSITIVITY ANALYSIS OF SPOT-WELDS IN BIW STRUCTURES FOR HIGH-SPEED CRASH

[1]Dr. Vitor Cores Finotto*, [1]Michal Styrnik, [2]Ionut Mihnea, [3]Michael Tryfonidis, [3]Zafeiria Kanellia*
[1]BMW AG, [2]ARRK-Engineering GmbH, [3]BETA / Cadence

KEYWORDS –
Spot-weld optimization, AI, Sensitivities, High speed crash, ANSA, KOMVOS.

ABSTRACT –
This study presents an end-to-end process for obtaining sensitivities, correlations, and a comprehensive range for optimization and regression models concerning variations in spot welds. Spot welds are essential for the precise and rapid connection of metal sheets in Body-in-White (BIW) structures, where large vehicles may contain over 7,000 spot welds. As a result, reducing the number of spot welds can lead to significant savings in manufacturing time and costs. This research focuses on a use case involving rear high-speed crash scenarios, where multiple energy and integrity requirements pose substantial development challenges. To evaluate the impact of reducing spotwelds, 23 design variables were parameterized and three Design of Experiments (DoE) were performed, leading a total of 600 full vehicle rear crash calculations. Multiple optimization algorithms and Artificial Intelligence modules were tested to navigate through the generated data and enable the effective reduction of spot welds without compromising performance. The results indicate that different numerical approaches are needed to address challenging load cases. The optimization findings demonstrate that multiple spot welds can be eliminated with minimal impact on performance. Furthermore, the optimization workflow has been successfully integrated into the development process, enhancing efficiency and effectiveness in BIW design.

TAILGATE OPTIMIZATION UTILIZING MACHINE LEARNING

[1]Konstantinos Rachoutis, [1]Dimitrios Drougkas, [1]Apostolos Paraschoudis , [1]Evripidis Ntinas, [2]Jinsoo Shin
[1]BETA / Cadence, Greece, [2]Hyundai Motor Group, Korea

KEYWORDS –
Optimization, Machine Learning, Multi-Body Dynamics, Automotive Closures

ABSTRACT –
In the lifetime of a vehicle, ease of use and quality of appearance is as important a goal as the longevity of the vehicle: engineers do not only need to manufacture a car whose various mechanisms will remain functional without defects after continuous use, but they must also ensure that the users will be able to operate it comfortably.
This study aims to optimize the design and manufacturing of the tailgate component of a vehicle on two fronts: manufacturing quality and user comfort. The optimization process involves the modification of the gas lifter components positions in each design iteration in order to perform Multi-Body Dynamic simulations followed by Structural analyses. The goal is to find an optimal design that maintains the deformations of the tailgate component at reduced levels resulting in optimum external appearance regarding panel gaps, as well as comfortable user operation.
Machine Learning predictive models (also referred to as predictors) are employed to accelerate the product design and evaluation process. Engineers can explore various what-if scenarios and extract the necessary key responses for each modification applied to the vehicle, to estimate its improved performance and usability, without sacrificing the design time. At the same time Machine Learning predictors are employed in Optimization studies, replacing the FE (Finite Element) Solver, in order to reach the optimum design in an automated and faster way, thus, improving the product development time.
In this study three optimization approaches are presented, utilizing machine learning methods that predict simulation results for two different analyses. Compared to the established "Direct" optimization method (design updates, FE analysis, post processing), the Machine Learning assisted Optimization methods significantly reduced the optimization time while maintaining similar levels of accuracy. This allowed for more optimizations studies resulting in reduced product development time and increased product performance

Session 6B

SYNERGY BETWEEN ANSA PRE-PROCESSOR AND CFD++ FLOW SOLVER FOR AUTOMATIC CFD MESH ADAPTATION

Davide Muffo
Leonardo Aircraft Division

KEYWORDS –
CFD, Mesh Adaptation

ABSTRACT –
Within the Computational Fluid Dynamics, the automatic mesh refinement is a method of adapting the computational mesh to the solution in order to obtain a more accurate prediction of the flow field, at the minimum computational cost.
The present work, carried out in collaboration with BETA CAE and Metacomp Technologies, presents the development of an automatic mesh adaptation process, leveraging automatic meshing capabilities in ANSA driven by indeal cell size distributions provided by the flow solver CFD++.
Two test cases are presented: an isolated wing, at transonic flight regime, and a complete aircraft, representative of a fifth generation combat platform, presenting many relevant flow features such as shock waves, flow separations and jet flow.
Among the others, one of the main outcomes is the capability of the process to simultaneously capture all the relevant flow features.

CONVERSION OF A CRASH MODEL TO AEROTHERMAL MODEL USING ANSA FOR CABIN SOLAR SOAK ANALYSIS

Sacha Jelic
ThermoAnalytics GmbH

KEYWORDS –
Aero Thermal Solar

ABSTRACT –
This study demonstrates the process of transforming a CAE model initially designed for crash simulation into one that is suitable for 3D aerothermal analysis.

This way, we can harmonize CAE models between different engineering disciplines in an efficient way to reduce pre-processing time.

This transformation involves several key steps and considerations, which will be outlined in detail. We begin by discussing the differences in mesh requirements between crash and aerothermal simulations. Crash models typically use coarse meshes with 1D, 2D and 3D elements tailored for high-strain and contact dynamics. Aerothermal models are made of 2D and 3D elements and continuous meshes in order to support fluid-thermal interaction and radiative heat transfer.

Another important focus will be the conversion of materials and physical properties. Materials in crash models often emphasize mechanical characteristics such as yield strength and strain rate sensitivity. In contrast, aerothermal simulations require thermal conductivity, emissivity, specific heat, and other temperature-dependent properties. We will explain how these properties are reassigned and validated during the model conversion.

Special attention will be given to handling complex features such as spot welds, which are critical in crash models but pose unique challenges when adapting to thermal simulations.

This work will be caried out Using a streamlined and highly automated process in ANSA from BETA-CAE.

The method will be applied to a case where the converted model is subjected to a critical transient solar loading scenario on a complete vehicle. We will show how the resulting temperature and stress distributions can be used as inputs for downstream thermomechanical and durability analyses, ultimately supporting a more comprehensive

AUTOMATED CFD WORKFLOW: ENHANCING AERODYNAMIC PERFORMANCE AT POLIMI MOTORCYCLE FACTORY

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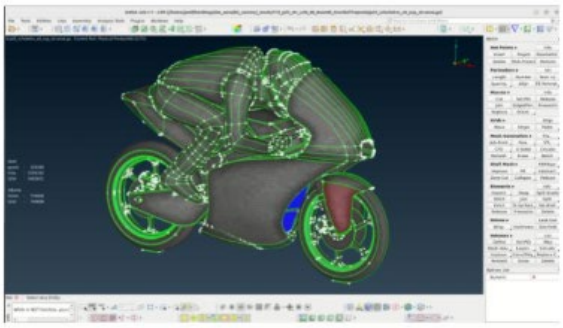
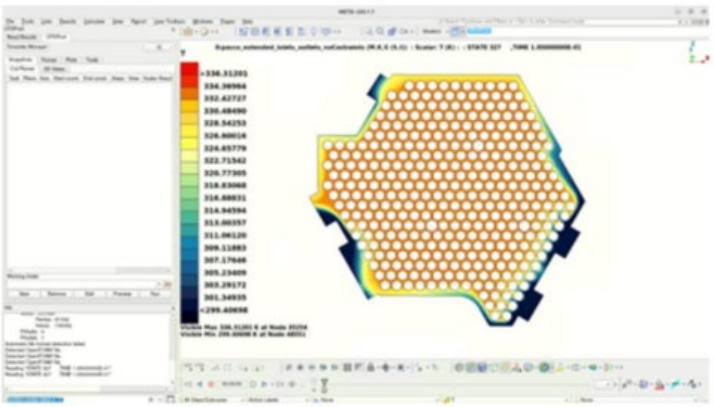
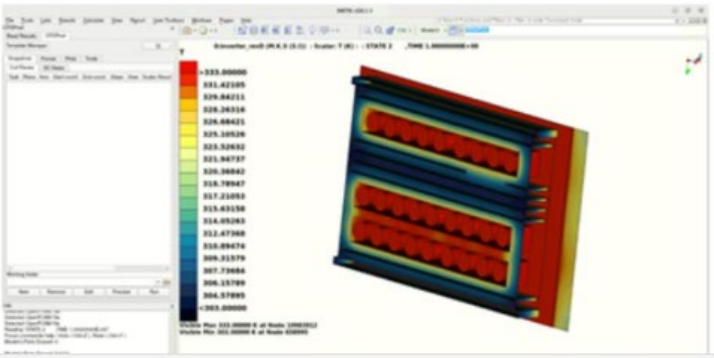
Polimi Motorcycle Factory, Italy

KEYWORDS –
CFD Methodology, Automation, Mesh Generation, Post Processing, Morphing

ABSTRACT –
Polimi Motorcycle Factory, the Motostudent team of Politecnico di Milano, highly relies on BETA CAE softwares for aerodynamic optimization. Parametric mesh setup, morphing, and API-driven process automation make it the best solution for our simulations, pushing performance over the limit.







Session 6C

TRIMMED IGA SHELLS AND SOLIDS IN LS-DYNA: LATEST DEVELOPMENTS, APPLICATIONS AND STUDIES

[1]**Lukas F. Leidinger***, [1]**Stefan Hartmann**, [2]**Dave Benson**, [2]**Liping Li**, [2]**Attila P. Nagy**, [2]**Lam Nguyen**, [2]**Marco Pigazzini**
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KEYWORDS –
LS-DYNA, Isogeometric Analysis, IGA, Trimming, Crash

ABSTRACT –
LS-DYNA and ANSA play(ed) a major role in bringing Isogeometric Analysis (IGA) [1] from academia to industry. Especially the capabilities of ANSA in generating analysis-suitable trimmed NURBS shell models out of existing CAD models enabled large-scale industrial applications. For example, Bauer et al. [2] modelled a Body in White with hundreds of trimmed NURBS shells in ANSA and successfully ran full vehicle crash simulations in LSDYNA.

Motivated by the increasing usage of casting parts, the concept of trimmed IGA shells was recently extended to trimmed IGA solids [3]. Herein, the basic idea is to embed the model geometry into a regular B-Spline background grid. First results indicated the large potential of the trimming approach for solids as it allows for a complete decoupling of geometry (accuracy of the model boundary) and mechanics (element size). Essential for explicit analysis is the use of higher-order and higher-continuity B-Splines as the basis for the background grid. This is the case because only higher continuity allows for a feasible explicit time step size.

For trimmed IGA solids, the primary tasks of ANSA are the definition of the model geometry in LS-DYNA input format and the definition of the B-Spline background grid. Defining the appropriate position, orientation and probably also the shape of the latter can improve the quality of trimmed IGA solid models. Starting from version 25, ANSA supports first capabilities for trimmed IGA solids and users will require further extensions for practical applications.

In this contribution, we present the latest developments, applications and studies about IGA in LS-DYNA and indicate how ANSA could support the introduction of the latest IGA technologies in industry.

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PRE-PROCESSING TOOLS AND TECHNIQUES FOR BUILDING IGA MODELS

[1]Ioannis Chalkidis*, [2]Lambros Rorris

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KEYWORDS –
IGA, NURBS, Immersed, Geometry, ANSA

ABSTRACT –
FEA simulations for shell and solid structures use tested workflows, based on robust pre-processing tools that have been developed over the last decades. Starting with a CAD model where thin-walled solid structures are being described by their boundary representation and ending up with a model ready to solve, is a challenging process for complex industrial parts like these we often meet in automotive industry.
Pre-processing such models with Isogeometric Analysis (IGA) involves several steps, from understanding the problem requirements to setting up the simulation model. Specify constraints and loads, define NURBS or unstructured Splines basis functions patches to discretize the computational domain, perform h-refinement (knot insertion) or p-refinement (increasing the polynomial degree) as needed for accuracy, simulate parts with areas of varying thicknesses, realize assembly points, apply initial stress – strain values etc. These are some of the parameters that should be considered to effectively prepare an Isogeometric Analysis model and leverage the power of NURBS or unstructured Splines to get more accurate and efficient computational analysis. This paper presents pre – processing tools and techniques required to simulate IGA models, resulting into a robust switching from FEA to IGA.
IGA solid analysis has been brought to the attention of the CAE community because of modern giga cast parts, that cannot be simulated with shell theory and the solution time increases dramatically for solid FE simulation. Pre – processing tools for immersed IGA solids Using solid meshes as interpolation mesh are also available in ANSA, giving great potential to engineers to work directly on geometries but on existing solids meshes as well. –

APPLICATION OF IGA TO AUTOMOTIVE NVH ANALYSIS

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[1]Applus IDIADA, [2]SEAT-CUPRA

KEYWORDS –
Isogeometric analysis, NVH, modal analysis, implicit, BiW

ABSTRACT –
Since its release in 2005, Isogeometric Analysis (IGA) technology has drawn significant attention for bridging the gap between CAD and CAE worlds. Recent years have seen substantial interest in automotive applications, with works demonstrating IGA's capability to simulate entire BiW structures Using shells [1], employ trimmed IGA solid elements from coupon to subsystem level including spotweld assemblies [2], and leverage continuously evolving features in ANSA [3] and LS-DYNA [4].

While industry adoption remains predominantly focused on crashworthiness simulations, where IGA shows great potential for casting parts despite known limitations around fracture due to the Cross-Talk effect [5], this study expands the scope by investigating IGA's potential for NVH performance through an implicit modal analysis of a Body-in-White (BiW) Using LSDYNA. One of the objectives of this work is to advance the widespread use of IGA for CAE analysis across the different vehicle performances.

Our process involved transforming a production NASTRAN BiW model to LS-DYNA and then creating an IGA model. Suitable LS-DYNA element type, materials and assembly equivalent to the ones present in the original NASTRAN model where investigated. For IGA, multiple parameterizations were benchmarked to identify optimal configurations balancing accuracy and computational efficiency. Results are compared to the original NASTRAN results. The work presented here is part of an ongoing inhouse project with the objective to assess current IGA readiness for NVH applicability and to identify any potential issue that may need improvement to allow the automotive application.

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Session 6D

LATEST DEVELOPMENTS IN ANSA/META FOR NVH APPLICATIONS

Vassilis Pavlidis
BETA / Cadence, Switzerland

KEYWORDS –

ABSTRACT –
Over the last two years a series of important features related to NVH have been implemented in BETA suite broadening the range of applications and offering elevated capabilities which can better facilitate the work of an analyst. First of all an analytical SEA solver along with a dedicated ribbon holding functionality intended to simplify the model build of a SEA model from an FE model has been introduced. The already well-established suite for reduced modelling has been enhanced further with more options for accurately accounting of damping as well as with a new Universal Joint type of connector in FRF Assembly. A new interface has been introduced for the easier application of the Modal Response tool for mainstream and simple cases such as the calculation of Driving Point Mobilities and Transfer Functions. Nastran based external superelements of Craig-Bumpton type have been supported in FRF Assembly along with the calculation of the respective mode participations, thus enabling the usage of constrained modes which, in certain cases, prove to be an efficient way in reaching the root cause of a non-accepted NVH behaviour. Moreover, reduced modelling capabilities have been extended to exterior acoustics through the calculations of responses based on the Rayleigh Integral method. But more important, with the latest version, two unique features have been introduced in FRF

Assembly as the outcome of a long time research by BETA CAE. The first is the calculation of the worst path within an assembly for a certain loadcase from the loads all the way to the response. The second is related to the assessment of the mode influence of any component to a specific response. Both capabilities are unique in the market, aiming at providing a better insight of the cause for a suboptimal NVH behaviour.

Finally, several important enhancements have been introduced in NVH Console such as the introduction of an FSI connector which allows for the handling of multiple cavities as individual components and the support of acoustic monopoles as loading conditions. New standard loadcases for imbalance loading and spindle loads have been added to the list of currently available loadcases, hence simplifying a lot the set-up of complicated loading conditions. Last but not least the DOE & Optimisation capabilities of NVH Console have been extended even more with the addition of design variables for panel thickness and shape changes. This allows for more sophisticated DOE and Optimisation studies, yet in a fast and accurate way

Session 7A

DEVELOPMENT OF AN AUTOMATED APPLICATION FOR CREATING PEDESTRIAN PROTECTION PERFORMANCE TEST AREAS USING THE ANSA PEDESTRIAN TOOL

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TOYOTA MOTOR CORPORATION

KEYWORDS –
Pedestrian protection, Crash safety, Automation, ANSA, Python

ABSTRACT –
In recent years, automotive development has become increasingly diverse and complex to meet customer needs, and there is a demand for shorter development periods to deliver attractive products in a timely manner. Therefore, it is necessary to enhance the efficiency of the development process by leveraging digital technologies. In this presentation, I will introduce an application developed Using ANSA's Pedestrian Tool feature to streamline the creation of evaluation areas for pedestrian protection performance. This application provides an environment where users can complete the entire process from setting conditions to checking results on the web, with minimal operation of ANSA, making it easy for users who are not familiar with ANSA to use it without a manual. The created evaluation areas are automatically saved, allowing for the utilization of accumulated data. This has led to a reduction in the labor and time required for area creation. Additionally, by incorporating agile development methodologies, we have established a development system that enables rapid prototyping and quick reflection of user feedback within a short period, allowing us to respond flexibly to user requests.

CAPTURING KINEMATICS IN CRASHWORTHINESS OPTIMIZATION

[1]Dr.-Ing. Vitor Cores Finotto*, [1]Dipl.-Tech.-Math Michal Styrnik*, [2]Dipl.-Ing. Zafeiria Kanellia, [2]Dipl.-Ing. Michail Tryfonidis,

[1]BMW AG, Germany, [2]BETA / Cadence., Greece

KEYWORDS –
Crashworthiness, Full frontal impact, Optimization, Kinematics, Clustering

ABSTRACT –
Crashworthiness is a critical aspect of vehicle development requiring effective dissipation of kinetic energy during collisions to protect occupants. Subsequently, optimizing Body-in-White (BIW) structures for crash performance involves addressing complex interdependencies among time sensitivity, material behaviour, and key performance indicators. Capturing and understanding kinematics within the optimization process is essential for generating design variants that meet crash requirements effectively.

This research investigates new methods for capturing full frontal crash kinematics, comparing their efficacy with existing optimization approaches and eventually how they complement each other in supporting the generation of improved design variants. By demonstrating how these methods can accelerate optimization processes, this study aims to contribute to the development of stable crashworthiness designs that enhance vehicle safety.

LATEST DEVELOPMENTS IN ANSA/META FOR CRASH & SAFETY APPLICATIONS

Thanassis Fokylidis
BETA / Cadence, Greece

KEYWORDS –
Crash, Safety, Includes, Lists, Checks

ABSTRACT –
Over the past two years, BETA / Cadence has focused intensely on developing advanced tools designed to empower Crash analysts to work more efficiently and effectively than ever before. Our specialized functionality ensures full compatibility with all major Crash solvers, adhering to the latest industry protocols and regulations while guaranteeing accurate and reliable solver execution.

This presentation will showcase a user-friendly interface organized with ribbon menus, featuring improvements such as enhanced drawing capabilities, an upgraded database browser, refined entity cards, and sophisticated multi-model management. Additional highlights include the special Include files handling, customized and solver specific numbering schemes, advanced validation checks, streamlined includes handling, and numerous other performance enhancements.

Furthermore, the latest updates in Crash and Safety protocols have been seamlessly integrated into ANSA/META tools, delivering increased expertise and robustness throughout loadcase construction and results evaluation. Key features covered in this session include advanced seat positioning based on frame points, the enhanced pedestrian tool, automated dummy positioning and finger handling (morph based), landmark positioning and scaling for Human Body Models (HBMs), as well as the latest updates in Vitual-Testing-Crashworthiness (VTC) and Occupant Injury Criteria (OIC) tools.

Join us to explore these cutting-edge enhancements that are setting new standards in Crash analysis efficiency and accuracy.

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STREAMLINING VIRTUAL TESTING CRASHWORTHINESS (VTC) ASSESSMENTS: AN INTEGRATED PRE- AND POST-PROCESSING WORKFLOW USING ANSA AND META

Manos Dagdilelis*, Thanasis Fokylidis, Nikos Tzolas
BETA / Cadence

KEYWORDS –
Dummy, Euro NCAP, barrier, Crashworthiness, ISOMME

ABSTRACT –
The automotive industry is continually evolving to meet stringent safety standards and enhance occupant protection in crash scenarios. With Euro NCAP supplementing far-side impact testing with Virtual Testing Crashworthiness (VTC) starting in 2024, real tests and CAE simulations come closer more than ever. The VTC protocol mandates the use of simulation and physical test data to robustly evaluate far-side impact protection, requiring detailed compliance with validation and quality criteria, as well as specific data formatting for submission. Consequently, apart from far-side more protocols will be implemented in the virtual testing raising more challenges to the safety engineers. As a result, there is an increasing need for efficient tools that streamline the assessment process offering 'know how' of the different protocols and simultaneously minimize the human interaction with the aid of automation.
This paper introduces the solutions that BETA CAE has come up with, in order to bridge CAE with real testing covering all the current but also the future needs of VTC. In ANSA the pre-processor a new tool has been introduced that automates the ATD/HBM positioning process following the specifications of each protocol or utilizing experimental data coming either from posture landmarks or scanned STL meshes. Along with the already known in the market, seat positioning, seatbelt and impactor tools form a complete suite to ensure an easy and proper preparation of the model for simulations. Additionally, an innovative software tool has been integrated within META, BETA / Cadence post-processor, designed to meet and exceed the requirements of the Euro NCAP VTC protocol. The tool offers comprehensive functionalities to facilitate the evaluation process, ensuring accuracy, efficiency, and compliance. Key features of the tool include the ability to read and process all necessary simulation and physical test results, and export the data in the ISOMME format with precise adherence to protocol requirements, ready to be uploaded to the Euro NCAP website. Additionally, the tool performs pre-assessment in the same manner as Euro NCAP, allowing automotive manufacturers to know their potential rating before submitting the results officially. This pre-assessment ensures that manufacturers can refine their designs to achieve the desired safety ratings.
By automating the critical aspects explained above, the aforementioned tools significantly reduce the time and effort required for vehicle safety assessments. They ensure that automotive manufacturers can efficiently comply with the latest Euro NCAP standards and beyond, ultimately contributing to the development of safer vehicles.

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Session 7B

LATEST DEVELOPMENTS IN EPILYSIS

Panagiotis Pantazidis
BETA / Cadence, Greece

KEYWORDS –
Epilysis, Optimization, Static, NVH, Dynamic, v25.x, v26.0, Whats New, Latest Developments

ABSTRACT –
In the latest Epilysis versions multiple technical advancements have been introduced in computational performance and functionality, reflecting comprehensive enhancements across multiple facets of the software. Key improvements include substantial speedups achieved through optimized algorithms, alongside refined memory and disk management strategies that enable efficient handling of increasingly complex simulations with reduced resource consumption.
Additionally, the solver now integrates advanced capabilities such as Buckling Analysis, enabling precise assessment of structural stability under critical loading conditions. Topography Optimization, which facilitates optimized design generation through automated bead pattern formation. Significant improvements have also been implemented within the AMLS solver, enhancing convergence rates and solution accuracy. Furthermore, the solver supports integrated ERP calculations within optimization workflows, effectively coupling with AMLS runs to improve reliability and performance of multi-parameter optimization processes. These improvements make the Epilysis Solver faster, more efficient, and provides engineers with powerful tools to optimize designs and ensure structural reliability.

VIRTUAL ENGINEERING STRUCTURAL ANALYSIS SOLVERS BENCHMARKING: EPILYSIS COMPETITIVE ASSESSMENT

Giuseppe Credo, Antonio Lesci
Dumarey Automotive Italia S.p.A

KEYWORDS –
Dynamic Analysis, Benchmark, Experimental correlation, Powertrain

ABSTRACT –
The increasing complexity of structural dynamics requires advanced computational tools combining accuracy, efficiency, and ease of use. In this study, it is presented a comprehensive comparative analysis of three structural solvers, highlighting the novel software EPILYSIS against two established competitors. The comparison evaluates key performance metrics, including accuracy of results, computational runtime, and overall usability.
A systematic benchmarking procedure was implemented on standardized structural problems representative of real-world scenarios in a powertrain analysis (Exhaust Line). EPILYSIS demonstrated distinct advantages in computational speed, outperforming competitor solvers by achieving significant runtime reductions while maintaining result accuracy, notably, in scenarios characterized by high complexity.
In conclusion, the benchmarking outcomes underline EPILYSIS robust potential as an efficient structural analysis solver, providing tangible benefits in terms of speed without reducing accuracy. Additionally, EPILYSIS demonstrated flexibility by successfully solving models originally created for competitor software, leveraging ANSA's advanced capabilities, and significantly minimizing the necessity for rework.

EFFICIENT BOLT LOOSENING ANALYSIS FOR INDUSTRIAL MULTI BOLT MODELS

Michael Klein
INTES

KEYWORDS –
Bolt Loosening Contact Thread PERMAS

ABSTRACT –
Bolts are frequently used as standard fastening elements for mechanical structures. In Finite Element (FE) analysis, there exist a great number of possibilities to model bolts dependent on the detail level and importance of physical representation. If an optimal ratio of modeling effort and accuracy is requested, the ANSA Connection Manager for solid bolts is an efficient solution. Stiffness behavior of solid bolts is on the same accuracy level as the remaining structure and pretension can be easily applied, but the thread is not detailed.
For fasteners which are mission critical, i.e. if bolts lose pretension during operation, additional physical parameters are needed. In many cases it is not necessary to make an absolute statement as to whether the screw will loosen or not. It is sufficient to state whether the tendency to loosen screws is increasing or decreasing. For this purpose, all detailed parameters such as flank angle, pitch, friction in the thread and thread direction are necessary, but complex thread detail modeling should be avoided if possible. With this knowledge, the assembly can be augmented through simulation and the efficient bolt by modeling with the ANSA Connection Manager can be kept. This leads to the main question: Is an augmented bolt functionality for models without detailed meshed thread sufficient to evaluate the tendency of loosening?
Advanced contact with thread system on cylindrical model is shown. The accuracy of the contact directions and the contact forces in the thread area is significantly increased Using screw parameters and thread coordinate system. At the same time, the modeling effort and the computing time are kept low.
The five main bolts of a rim connection are shown as an example. After explaining the general sources of screw loosening, results from changes in the parameters for preload force, pitch angle, thread direction and friction coefficient are shown to demonstrate the functionality and the effectiveness of the method. It is shown that the tendency of bolt loosening for industrial models with multiple bolts can be detected and analyzed by FE simulation

VIRTUAL CLAMPING AND RETOMO: THE FUTURE OF VIRTUAL QUALITY CONTROL

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KEYWORDS –
Virtual Clamping, RETOMO, CT, Quality Control, digital twin

ABSTRACT –
Achieving top product quality requires meeting strict standards and passing rigorous quality control processes. Traditionally, identifying flaws during physical inspections often leads to costly and time-consuming redesign and manufacturing cycles. To mitigate these challenges, simulation-based tools and methodologies have emerged as powerful alternatives.
BETA / Cadence has developed a suite of innovative solutions in close collaboration with Quality Assurance teams, enabling virtual quality control and reshaping industry standards. Tools such as VCA (Virtual Clamping Analysis) and RETOMO—used to create accurate digital twins from computed tomography (CT) data—facilitate early flaw detection and virtual validation of physical parts.

This presentation will explore the latest developments integrated into these tools, address the challenges they were designed to overcome, and demonstrate how virtual simulation enhances efficiency, accuracy, and cost-effectiveness in quality control workflows.

Session 7C

NEW DURABILITY PROCEDURE FOR VIRTUAL SHAKER TABLE USING A FULLY TRIMMED BODY AS MNF MODEL

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KEYWORDS –
Complete vehicle simulation, Multi Body Dynamics MBD, Road Load Data RLD, modal transient, enforced motion, virtual shake table, durability, structural fatigue, spotweld fatigue

ABSTRACT –
When Using a virtual shaker table scenario for fatigue simulation, the load definition is a crucial part of the process. One possibility is to use the enforced motion approach in a modal transient analysis as load.

The first part of this presentation shows how the acceleration can be extracted from a Multi Body Dynamic MBD simulation. Since a fully trimmed body including all subassemblies is used as flexible model (mnf), the different mounting points of the subassembly can be specified in order to request the acceleration output. This means that the shaker table simulation contains several excitation points. To use multiple excitation points in a modal transient analysis correctly, a deeper understanding of the enforced motion approach is needed. By comparing the enforced displacement with the enforced acceleration approach, the different aspects including the limits which have to be considered are highlighted.

The second part of the presentation is focUsing on the fatigue evaluation process, which uses the outcome of the modal transient analysis. It is performed in META FATIQ. A front seat of an autonomous taxi (ZEEKR, WAYMO) is chosen as example. The workflow begins with initialization of the model and material property assignment, followed by configuration of fatigue parameters corresponding to the entity to be evaluated (structure, spotweld, seam weld). Load definition involves mapping different events from the MBD simulation to corresponding subcases. The solver executes a fatigue life calculation Using the time history of the stress in the structure and the forces in the connections from the shaker table simulation. Damage and life predictions are computed per event and as cumulative totals. The fatigue results in the structure and in the connections are shown as contour plots including the event contribution, while further insights such as stress histories or rainflow charts can be obtained for the areas of interest.

AUTOMATED ANALYSIS OF SLIPPING FAILURE IN BOLTED JOINTS USING CONTACT FORCES

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KEYWORDS –
bolt assessment, automation, tool, gearbox

ABSTRACT –
A reliable bolted connection is crucial for the proper functioning of a gearbox, ensuring the secure integration of components and efficient transmission of force and motion. Without a high-quality bolted connection, the gearbox could experience failure or malfunction, impacting both performance and safety.

We are capable of evaluating and assessing bolted connections through calculations. Based on the results, we implement targeted design modifications, such as repositioning of bolts, changing their number, adjusting the pretension force, or altering the bolt class. Such design actions directly impact slipping—a critical failure mode of bolted joints—which must be evaluated carefully.

Slipping is assessed by monitoring the friction coefficient over time. Traditional methods for extracting friction data from finite element (FE) analysis involve time-consuming manual processes, including defining individual node sets, exporting relevant quantities, and processing results in spreadsheets that require adjustments for each flange and bolted joint.

To streamline this process, BETA / Cadence, in collaboration with our team, has developed an advanced evaluation tool that fully automates friction assessment. This tool eliminates the need for lengthy and manual set definitions by automatically summing contact normal and transverse forces surrounding each bolt. The results are presented as annotations assigned to each bolt or as curves illustrating friction coefficient variations over time, providing clear and intuitive insights, unlike previous methods that required searching through long and complex spreadsheets.

This newly developed tool has significantly accelerated the bolt evaluation process (from hours or days to minutes), eliminated errors, and made it possible to automate this evaluation process in every design loop, allowing for more frequent assessments.

MNF CREATION AND E-LINE METHOD - KEY ENABLERS TO EVALUATE VEHICLE BODY DISTORTION IN MBD

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KEYWORDS –
Multi Body Dynamics MBD, Multi Stethoscope MSS, Opening Distortion Fingerprint ODF, Component Mode Synthesis by Craig-Bampton

ABSTRACT –
A new method for evaluating vehicle body stiffness has been developed by Zeekr Technology Europe (ZEEKR) over the past years. The method is called Opening Distortion Fingerprint (ODF) and has been implemented by BETA / Cadence (BETA). With the ODF, the quasi-static response in a complete vehicle setup can be effectively assessed. This applies to both simulation and test.

For simulations, ZEEKR has developed a new procedure where a Modal Neutral File (MNF) of the fully trimmed body model including the MSS is imported into a multi body dynamics (MBD) environment. This enhanced MNF model makes it possible to evaluate the ODF directly based on MBD results. To understand how the MNF creation affects the results from the ODF, Component Mode Synthesis (CMS) needs to be considered. As examples of CMS, the presentation will show how the Craig-Bampton reduction can be used on a simplified example. From the example, some parameters which have an impact on the MNF creation are highlighted.

In the second part of the presentation, the distortion evaluation (ODF) is shown more in detail. Two methods are available to evaluate the distortion in the body openings: the E-line method and the Diagonal method. The important aspects are shown on how to identify the distortion in a nonlinear environment.

As an outlook, the application of MSS and ODF on the newly developed robot taxi (ZEEKR & WAYMO) is presented. Since this taxi has a B-pillarless body and a new side door concept, the new approach becomes even more interesting in the context of a correlation.

LEVERAGING MULTISCALE MODELING FOR THE PREDICTION OF COMPOSITE MATERIAL RESPONSE

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KEYWORDS –

ABSTRACT –
Material innovation is critical across industries, particularly for the design of lightweight and sustainable products. Accurately capturing the complex behaviour of composites remains a significant challenge in engineering design and analysis. This challenge highlights the importance of multiscale modeling techniques, which provide a comprehensive understanding of material response across various length scales.

This work outlines a framework that enables multiscale modeling of composites within a multidisciplinary environment. The process begins at the microscale, where an RVE (Representative Volume Element) Generator is used for virtual material characterization. The RVE of a Woven composite material is generated, set up and analysed with FEA. This analysis yields homogenized composite properties, which are then used to create solver material cards for subsequent macroscale analysis.

In the second step, microscale data are utilized to create a laminated model of a composite component. After the meshing process, the efficient build-up and inspection of the composite lamination are carried out too. Once the laminated model is complete, it is adapted for various analyses, with boundary conditions and all required analysis parameters set for multiple load cases.

Finally, the composite model is prepared, and the FEA simulations are submitted and monitored. Post-processing results from laminated component analyses can be complex, as tensor results and material history variables exist through the thickness. To address this, a new toolset for post-processing composite results is being used. This toolset facilitates a range of actions, from massive results reading and handling materials to identifying critical areas, generating through-the-thickness plots, and recording post-processing actions.

In summary, this integrated approach streamlines the entire workflow—from material characterization to final post-processing. It empowers CAE engineers to efficiently design and analyse advanced composite structures, meeting the demands for innovation and sustainability in engineering.

Session 7D

AUTOMATED STRUCTURING AND RENAMING OF ENTITIES IN SIMULATION MODELS

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KEYWORDS –
ANSA, automation, renaming, renumbering, model structure

ABSTRACT –
Model structure plays a crucial role in the entire simulation process – the model must be error-free, well-organized, and consistent. This is especially important in large-scale projects involving dozens of contacts, hundreds of sets, and other types of entities. ANSA, as a powerful pre-processing tool, provides a wide range of features for managing such data. However, when dealing with highly complex models, it can be beneficial to further enhance the workflow through automation and standardization.

In practice, entities are often inconsistently named and irregularly numbered. For example, contacts refer to master and slave sets that may be numbered without any mutual logic and sometimes reused across different parts of the model, such as for various types of analyses.
Our Python script enables automated renumbering of key entities (e.g., contacts) and their logical association with related sets. Other sets, used for boundary condition definitions or model validation (e.g., mass checks, balancing), are automatically grouped by name prefixes, significantly improving model clarity. Definitions used in different load cases are also systematically reorganized.

The scripting in Ansa allows direct access to definition data without the need to understand complex data structures. Users work with names as they appear in ANSA's interface, which correspond directly to solver-specific definitions and parameters. The script supports both full-model operations and selection-based workflows through familiar ANSA dialogs and filtering options.

This approach significantly speeds up model preparation and reduces the risk of human error. Automated consistency checks and logical naming schemes facilitate model validation and help detect inconsistencies early. The script has proven especially useful in collaborative environments – supporting standardized workflows across teams and improving clarity when models are handed over or revisited after a longer period.
The tool also includes a renaming module that can be used without any Python knowledge – supporting batch renaming, prefix/suffix management, and more. The script is easily extendable to other entity types (e.g., properties, materials, prestress) and features a simple GUI with the option to save settings for repeated use. Although originally developed for Permas, its core principles are easily adaptable to other solvers such as Abaqus.

PYTHON INTEGRATION IN THE BETA SUITE

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KEYWORDS –
Python, API, NumPy, VS Code, venv

ABSTRACT –
BETA has been among the pioneers on introducing Python APIs in the CAE industry, as Python was first integrated into the BETA Suite back in 2013 and since then offering continuous upgrades, so that the latest Python version and features are always available. New APIs have been introduced, integrating efficient structures, like Iterators and NumPy arrays, which result in much better performance and memory consumption.

Furthermore, BETA is offering a complete development environment, by providing a must-have set of scientific modules, while also supporting package managers and virtual environments (like pip and venv), to build upon those modules and extend them.
And this is all happening through the integration with Visual Studio Code, which offers state-of-the-art development capabilities and has also been customized to offer BETA specific actions and APIs documentation.

Apart from all the professional tools to develop code, BETA is also offering seamless integration of the Python tools in the software, as the graphics library is common and the APIs expose all the core functionality. The Python tools can be placed anywhere among the hardcoded ones on the new ribbon interface, seamlessly affecting the GL area, while when there's a need for intense performance, C APIs are also available to handle specific tasks. Finally, the importance of the BETA Suite Development Platform is shown through some statistics gathered from the number of built-in Python tools, as well as the number of conference presentations that are utilizing those technologies and capabilities.

META: QUICK COMPONENT EVALUATION

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KEYWORDS –
Scalar Set Evaluation, Automation, Diagram, Multiple Load Cases

ABSTRACT –
The simulation of components with multiple load cases usually generates a large amount of output data, which is time-consuming to process manually. The meta evaluation tool presented provides a convenient way for users to quickly analyse components. Areas of interest - element sets - are predefined in the model, typically at stress concentration locations such as sharp corners, holes, notches and fillets. From each evaluation set, a progression line of selected min/max scalar result variable is then automatically generated across all load cases in the form of a line diagram. This allows the user to immediately identify the critical load case as well as the most stressed location of the component. Options for further set filtering are implemented - the user can select sets for evaluation from all sets present in the current model. As an example, the Femfat fatigue simulation of a rotating component is presented, where the fatigue safety factor over the rotational frequency is evaluated. Thanks to Meta, this tool allows the user to post-process the results independent of the solver.

Session 8A

DEVELOPMENT OF SCALABLE HUMAN BODY MODEL BASED ON ANTHROPOMETRIC DIVERSITY USING ANSA'S SCALING TOOL

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KEYWORDS –
Human body models (HBMs), Anthropometric Diversity

ABSTRACT – Human Body Models (HBMs) have become increasingly pivotal in automotive safety research and will soon become integral to regulatory protocols such as the Euro NCAP occupant and pedestrian evaluations. Current HBMs, like THUMS and GHBMC models, cover specific body types (e.g., 50th percentile male, 5th percentile female), but lack the flexibility to represent the broad diversity of the human population. This limitation constraints advancements in individualized safety systems tailored to different body types and sizes. To overcome this constraint, Volkswagen AG, in collaboration with VAIVA GmbH, initiated a proof-of-concept project to develop an automated approach for generating a wide range of HBM variants. The project utilizes ANSA Scaling Tool, enhanced with metadata from the PIPER project and anthropometric data from established databases like ANSUR. The tool enables automatic, efficient, and anatomically consistent morphing of HBMs by scaling skin surfaces and adjusting internal structures such as muscles and bones in harmony. In the pilot case, the VW group AM50 HBM was successfully scaled to represent 50th percentile chinese male population. The morphing process required only a few minutes, with minimal manual correction needed, and yielded a high-fidelity model suitable for simulations. This approach supports both whole-body and segmental adjustments, allowing for precise, individualized modifications. The success of this pilot study demonstrates the tool's future ability to rapidly and reliably generate diverse HBM variants, enabling improved individualized safety designs. Future work will expand this methodology to support the generation of models across different sizes, and genders, contributing to safer automotive environments for all occupants and other road users

POSITIONING OF HUMAN BODY MODELS IN ANSA FOR CONSUMER SAFETY TESTING SCENARIOS

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KEYWORDS –
Human Body Models, Positioning, Articulation, Euro NCAP

ABSTRACT –
Human Body Models (HBMs) will become an integral part of virtual testing procedures in consumer vehicle safety assessments in the near future. Starting in 2026, Euro NCAP will initiate a monitoring phase that requires the use of HBMs in multiple seating positions for each newly developed vehicle. The results of these simulations must be submitted as part of the consumer rating process.
In preparation for these upcoming requirements, we employed an internal BMW tool named ProDSiG (Procedure for Dummy, Seat and Belt system positioning). ProDSiG is a script-based graphical user interface that integrates various tools within the BETA CAE ANSA environment. Among others, the workflow includes an initial seat compression simulation with the HBM, followed by the articulation of the model Using the Marionette Method integrated in the wide-range of HBM-specific tools within ANSA HBM toolchain. This method enables precise and repeatable positioning of the model's extremities and body structures to target postures, and is the focus of this study. The workflow concludes with a belt-routing simulation to ensure realistic interaction with the restraint system.
The accurate positioning of HBMs is essential to obtain reproducible and biofidelic simulation results. As Euro NCAP begins incorporating HBMs into its evaluation protocol, positioning can potentially influencing safety development and regulatory compliance in future vehicle designs. Reliable positioning will be a key criterion in demonstrating vehicle performance in virtual assessments.
This study details the sequential steps of the positioning procedure and demonstrates the workflow through an example application aligned with the anticipated Euro NCAP evaluation framework

PRE-PROCESSING AND POST-PROCESSING OF HBMS IN ANSA AND META

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KEYWORDS –
HBM, Human Body Model, Safety, Crash

ABSTRACT –
Human Body Models (HBMs) are critical tools for safety simulations within the automotive industry, facilitating progress in virtual testing, certification, and injury prevention. Nonetheless, pre-processing and post-processing these models to comply with industrial standards remain intricate tasks.

There are mainly two challenges related to pre-processing. First, positioning the model and deforming the mesh as needed, and second, producing variants based on a base FE model and adapting it to new anthropometric data.

To address the initial issue, ANSA provides a solution that simplifies the positioning and handling of an HBM, making it comparable to working with an ATD model. By incorporating an MBD solver with morphing algorithms, ANSA supplies a tool for real-time articulation and positioning.

We are simultaneously developing algorithms to address the second problem, utilizing morphing and remeshing tools in conjunction with methods to integrate anthropometric data into our algorithms.

In parallel, we engage in research activities focused on examining and analyzing the posture of motorcycle and bicycle riders. By doing so, we support ongoing initiatives aimed at designing safer vehicles for all road users.

In the future, we foresee the integration of various algorithms, including morphing, remeshing, and kinematics, along with datasets such as finite element (FE) simulation data and metadata like anatomical landmarks. This integration aims to offer a comprehensive solution for positioning and variability adaptation of any FE model to accommodate different positions and anthropometric measurements.

On the post-processing side, the META HBM tool automatically creates all needed reports including videos and images, strain contour plots, elements erosion identification, chest-bands deformations, and injury criteria calculations (Brain CSDM, Abdominal soft tissue organs SED, etc.). Time history results can be extracted from the Occupant Injury Criteria tool and Injury criteria like HIC, BrIC, Nij, etc. are calculated.

BEHAVIOR OF VARIANT HUMAN BODY MODELS ON DIFFERENT RESTRAINT SYSTEMS

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KEYWORDS –
Scaling, Restraint systems, HBM, Variant, Sled test

ABSTRACT –
Restraint systems have traditionally been developed based on the anthropometric characteristics of the average male, potentially reducing safety for individuals with different body proportions. Expanding simulations coverage to a wider range of body types is essential, but current Human Body Models (HBMs) lack high anthropometric diversity due to the high cost and time required for development.

To address this limitation, this research introduces the HBM Scaling Tool designed to adapt existing HBMs to variant anthropometric profiles. A comparative analysis is conducted between THUMS AM95 and THUMS AM50 scaled to AM95 anthropometrics Using the developed tool. The comparison focuses on multiple criteria, including mass distribution, center of gravity (COG), body morphology, bone dimensions, and elements quality.

Validation of the scaled model is performed through sled test simulations configured similarly to the Vezin et al. (2001) study. Acceleration in the head, spine, and pelvis—are analyzed, along with major principal strain patterns in the ribs. The results are compared with those from the original THUMS AM95 model and available experimental data from the Vezin study.

This research highlights how the proposed scaling approach enables more representative occupant simulations, supporting the development of restraint systems that are better suited to a diverse population.

Session 8B

DEPLOYMENT OF ANSA PRE-PROCESSOR AT FORD CLIMATE CONTROL SYSTEMS ENGINEERING

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KEYWORDS –
ANSA, Kinetics, Cabin air handling, Climate Control, CFD modeling process

ABSTRACT –
Nowadays, the development times of industrial products are becoming shorter and shorter, and at the same time there is a demand to increase quality and reduce costs. All known development processes have the goal of “on-time delivery” in common and this goal is achievable if the product developer can meet the following conditions: reducing complexity, general standardization, and efficient handling of noise-factors.
3D CFD analysis plays a crucial role in modern product development, where the requirement to minimize the time required to prepare a CAD assembly and a watertight model is of utmost importance. Therefore, standardizing of the common model-built approaches and tools is fundamental to successful product design.
Climate Control Systems Engineering Attributes handles development of in-cabin components like different types of air ducts, panel registers and air extractors. Apart from hardware development CCSE attributes carries out numerical assessments on vehicle glasses defrosting / defogging behavior, in-cabin temperature stratification and humidity sensor placement. Each of the above disciplines must be evaluated by CFD simulations, where the high-quality model and numerical mesh are achievable with standardized environment within Beta ANSA. From importing model parts from PLM, including kinetics, to advanced meshing approaches and batch mesh deployment, Beta ANSA enables all these tools to be accommodated in one environment.
The following study was conducted by verifying the different meshing techniques with the aim of making the future model creation and meshing processes efficient and simple and ensuring a short turnaround time. The ability of Beta ANSA to provide the most suitable solutions to the standard CCSE tasks led to the decision to integrate Beta ANSA into the global development process at FORD CCSE.

CHARACTERIZATION OF WHEEL WAKE BY REALISTIC TIRE DEFORMATION USING EDDY-RESOLVING CFD SIMULATIONS

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KEYWORDS –

ABSTRACT –
In addition to wind tunnel testing, Computational Fluid Dynamics (CFD) simulations play an important role in vehicle development. The aim of this work is to capture the real deformation of tires during rolling under load by CFD simulation and identify the flow phenomena that occur in wheel wake Using eddy-resolving turbulence model. From industrial point of view is the goal a possible reduction of costs and turnaround time in vehicle development by integrating computational fluid dynamics into the production process.
The generic car mock-up DrivAer was selected for this study. Two different rim sizes 16” and 19” were investigated, where the tires differ in tire grooves. Each wheel is exposed to two different vehicle loads which represent two tire deformations.
The whole meshing process was performed in pre-processing software Ansa. Because the focus is on wheel wake, the extensive effort has been put into meshing the tire geometry. The tire deformation was achieved by surface morphing. To ensure the stability of the calculation, the tire tread was meshed with a structured surface grid. As highlight of the meshing strategy is the meshing of the volumes of the tire grooves with a fully connected structured grid. Thanks to the use of a structured grid, significant cell savings are achieved compared to an unstructured grid.
The simulations were carried out in the solver OpenFOAM. The turbulence was simulated with an eddy-resolving DDES (Delayed Detached Eddy Simulation) turbulence model. The rotation of the wheels was authentic reproduced by rotating sliding mesh on the rim, by a velocity boundary condition on the tire and by the MRF (Moving Reference Frame) regions in the transverse grooves.
In such a highly complex simulation of vehicle aerodynamics, the grid quality plays an essential role. Thanks to the grid constructed in Ansa pre-processor, sufficient calculation stability and convergence were achieved. To evaluate the simulation results, the aerodynamic drag and the pressure distribution on the vehicle were compared with the experimentally measured values. In addition, the flow pattern at the front wheel was evaluated and compared in numerous cutting planes.

INTELLIGENT AERODYNAMIC PERFORMANCE PREDICTIONS FOR EARLY DESIGN PHASES AND OPTIMISED AUTOMOTIVE DESIGNS

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KEYWORDS –

ABSTRACT –
In the Artificial Intelligence (AI) era, there have been numerous implementations of the technology in the field of Computational Fluid Dynamics (CFD) simulations. By leveraging AI techniques, engineers obtain access to efficient CFD results predictions, whose accuracy has been improving ever since the initial attempts noted several years ago. The impact of AI on CFD predictions for external automotive aerodynamics is considered revolutionary, as it has the potential to enable flow predictions in fractions of the time required for a complete fluid flow simulation. The latter is particularly crucial during the early design stages of a newly developed vehicle, where predictions of aerodynamic performance are required at the absence of final, high-quality Computer Aided Design (CAD) models. Moreover, optimisation studies that are often performed both, on individual components and on full vehicle aerodynamic performance are greatly assisted and accelerated by the same technology. We envision a framework, where AI models could be trained on past simulation data to assist the development of future vehicles. Inclusion of such functionality in mainstream Computer Aided Engineering (CAE) tools unlocks the potential of quick model parametrisation coupled with on-the-spot results, minimising turn around times and simplifying an inherently complex process for the analyst. The current study presents the integration of powerful AI techniques in the CAE toolset, providing the opportunity to engineers and analysts to introduce AI-assisted development in their workflows. The functionality is demonstrated both, as a tool to assist design during the early concept phases of a project, and as an accelerated way for optimisation of components, or parametrised objects. Results appear to have satisfactory accuracy and overall performance metrics.

COUPLED SPH-EPILYSIS SIMULATION AND EXPERIMENTAL VALIDATION DURING VEHICLE WADING

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KEYWORDS –
SPH, EPILYSIS, ANSA, Waterwading

ABSTRACT –
This study investigates the structural performance of vehicle underbody covers during water wading events, with a focus on strength response to transient hydrodynamic pressure fields and their validation with experimental results. Traditional physical testing in wading channels is both time-consuming and costly, highlighting the need for accurate and efficient numerical simulation techniques. This initiative focuses on a high-fidelity numerical framework to evaluate the structural response of such components, including the engine splash shield and floor panels, subjected to transient hydrodynamic loads during wading events. A Smoothed Particle Hydrodynamics (SPH) solver is employed to simulate the complex, unsteady water flow and its non-monotonic pressure distribution across the vehicle underbody. To capture these effects, various ANSA modules were utilized throughout the simulation workflow—from CAD preparation and morphing to kinematics and structural analysis Using EPILYSIS. As the vehicle enters the wading channel, it experiences significant hydrodynamic loads on the front, the engine splash shield and underbody floor, contributing to structural fatigue. A one-way fluid-structure interaction (FSI) approach is used to couple the SPH solver results with the EPILYSIS structural solver. Notably, a non-monotonic pressure distribution is observed: as water enters through frontal airways, it accumulates above the underbody floor, generating elevated localized pressure during traversal. The study also discusses challenges related to particle resolution, numerical stability, and computational efficiency. Simulation results are compared against physical test data provided by BMW Group to validate the methodology. The findings demonstrate the effectiveness of SPH techniques in capturing complex fluid-structure interactions, reinforcing their value for virtual prototyping and early-stage vehicle design decisions.

Session 8C

CMS AND FBS TECHNIQUES IN BETA CAE SOFTWARE

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KEYWORDS –
Sub-structuring, superelements, CMS, FBS, NVH

ABSTRACT –
Dynamic sub-structuring (DS) has always played a significant role in structural dynamics. Analysing a structural system component-wise instead of solving the entire system offers several advantages as it reduces the analysis time and facilitates additional root cause analysis types.
DS techniques can be divided in two classes: Component Mode Synthesis (CMS) methods and the FRF based sub-structuring (FBS) methods. The first methods represent components by their modal contend; a well-known example is the Superelement (SE) technique implemented in Epilysis and other FE solvers. In contrast, the latter methods describe the components by their Frequency Response Functions (FRF). The FRF-Assembly tool in META deploys an FBS method and it is utilized in the assembly process of NVH-Console, the NVH framework offered in ANSA.
The purpose of this presentation is to:
(a) Demonstrate the various options how the subs-structuring methods are deployed in BETA CAE software focUsing on the latest developments in Epilysis and META.
(b) Discuss the numerical accuracy of both methods.
(c) Examine the influence of boundary condition and of damping assumptions applied in the numerical analysis.
Initially, the two sub-structuring techniques are briefly introduced. Whereas the SE techniques used in Epilysis follow the standard approaches commonly adopted by commercial software vendors, such as the Craig-Bampton and the Craig-Chang method. Meanwhile, the FBS technique used in META employs a numerically efficient and accurate assembly technique called Generalized Receptance Coupling (GRC).
Finally, numerical results for both methods are presented and discussed in the context of the vibro-acoustic FE analyses of a trimmed body model of a passenger car.

REDUCING VEHICLE INTERIOR NOISE THROUGH INSTANTANEOUS STRUCTURAL INTENSITY ANALYSIS AND ENERGY CONTROL

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KEYWORDS –
Road noise, Motor noise, Structure borne sound, Vibrational energy, instantaneous structural intensity, Finite element method (FEM)

ABSTRACT –
Structure-borne noise, such as road noise and motor noise, is a crucial NVH (Noise, Vibration, and Harshness) factor that directly impacts passenger comfort. This presentation explores a novel approach to reducing such noise by focUsing on the propagation of vibrational energy. Theoretical foundations, analytical techniques, and numerical validation Using a vehicle body FEM model are discussed.

Structure-borne noise originates from vibrations generated by excitation sources, which propagate through the vehicle structure to radiate from body panels. Based on wave equations, the transmission characteristics of vibrations are primarily governed by propagating wave components. This study proposes a new theory that efficiently reduces noise by controlling the transmission of vibrational energy carried by propagating waves to body panels.

To achieve this, the concept of instantaneous structural intensity (SI) is employed to quantify the flow of vibrational energy immediately after excitation, where propagating waves dominate. A visualization technique Using streamlines has been developed to illustrate these energy flows. The study further demonstrates through numerical validation how structural modifications can effectively block the energy transfer to body panels, resulting in reduced interior noise.

This research not only introduces a groundbreaking methodology for analyzing and controlling vibrational energy but also highlights its practical application in vehicle interior noise reduction. The results pave the way for innovative noise control technologies that enhance passenger comfort through efficient and targeted energy flow management.

STREAMLINING FULL VEHICLE NVH SIMULATIONS IN A SIMULATION PROCESS AND DATA MANAGEMENT ENVIRONMENT

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BETA / Cadence, Greece

KEYWORDS –
Reduced Models, NVH simulations, Simulation Data Management

ABSTRACT –
Modular approach of reduced models enables efficient structural and dynamic analyses by significantly reducing computational demands without compromising accuracy.
Inherent challenges emerge with the development of reduced models. The definition of reduced models requires expert knowledge and is often the result of a try and error approach to achieve a balance between simplification and accuracy in encapsulating the complete model's main characteristics. Then, the creation of alternative representations of reduced models, as well as the creation of new reduced model versions for every modification of the detailed FE-representation of the model, unveil another inherent weakness of the standard practices; The lack of traceability, that completely hinders collaboration between simulation engineers.
The implementation of a Simulation Process and Data Management (SPDM) system represents a transformative approach to managing simulation workflows and data. On the data management side, such a system enables generating various reduced model types and maintaining traceability of source models and dependencies, it ensures end-to-end transparencies and allows effortless transitions between full FE and reduced representations. Moreover, the system significantly enhances "what-if" analyses and optimization processes by properly documenting simulation iterations, enabling clear and comprehensible comparisons between variations. On the process management front, SPDM systems facilitate the standardization and automation of CAE workflows. These capabilities lead to the automation of generating reduced models and the submission of reduction runs to the solvers on the HPC systems, followed by systematic storage of results linked to their respective reduced models.
SPDM systems address critical challenges in simulation model preparation and analysis, including data sharing, integrity, traceability, and version control. Ultimately, adopting SPDM systems not only accelerate the end-to-end simulation process but also fosters innovation and productivity across engineering teams.

MASTER YOUR DIGITAL TWIN: THE SMART PATH TO CERTIFICATION

Carine Kamtchueng
Circoncellionne CK

KEYWORDS –
Digital transformation, twin, aerospace, simulation

ABSTRACT
The transition from physical testing to virtual design and validation lies at the heart of digital transformation in the aerospace industry. This shift offers clear advantages: it minimizes risk exposure and safeguards brand reputation by automating compliance processes, while also streamlining the management and publication of conformity documents and certificates.
As aerospace companies aim to optimize model management and enhance process transparency, Product Lifecycle Management (PLM) solutions are becoming increasingly essential. These platforms connect geometric and functional data across the organization, enabling centralized coordination throughout the development cycle. However, to fully harness automation, standardized models and load cases are crucial. By linking geometry with functional simulation, validation evolves into a continuous, structured process—no longer a workaround, but the foundation of product certification.
With SPDRM, BETA's workflow manager, it's possible to implement functional workflows precisely tailored to development processes.

Session 8D

AUTOMATIZATION OF FE MODEL GENERATION FOR PCBAS WITH ANSA-PYTHON INTERFACE

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KEYWORDS –
PCB, automation, FE model generation, ODB++, homogenization

ABSTRACT –
The trend towards electrification of vehicles requires an increased number of electronic components which need to withstand different environmental influences, like thermal, vibration and static loading. To date, it is difficult to simulate complex structures and material parameters of printed circuit boards (PCBs). Fine PCB structures like traces, vias and plated through holes (PTHs) combined with electronic assembly components (SMDs) lead to excessive usage of computing power that is necessary to generate and analyse these kinds of finite-element-models (FE-models). Modelling every detail can lead to several million elements.

Consequently, a solution needs to be found to reduce the model size while retaining the complex structural information as good as possible. In addition to model reduction, the automation of model creation is essential since it is not possible to manually create models with several hundred components. However, automation of model creation requires a programmable interface of the pre-processor. ANSA offers a very suitable interface to use python in combination with FE modelling. In this presentation, we will show which automations have been implemented by ANSA to support the calculation engineer in performing dynamic analysis of solder joints, static analysis of PCB strains caused during PCB mounting, and thermal strains.

As a result, multiple python and ANSA-python scripts are combined in one user interface for automated FE model generation. At first ODB++ data needs to be parsed and converted into a usable format, what happens outside of ANSA. This parsing step is followed by constructing geometry by linking points with curves, projecting them onto surfaces and generating mesh, all within the ANSA-python interface.

The PCB itself can be modelled in detail with every layer, trace, via etc. meshed with solid elements or with a coarse mesh, where every element has an individual homogenized orthotropic material based on the material distribution of the PCB area inside the finite element borders. It is also possible to combine these two modelling approaches with a detailed model in a region where the focus is laid and material homogenization outside. Additionally, there is also an automated process for SMD modelling which generates a simple SMD body and detailed solder joints mesh for each electronic component.
In conclusion, this software uses the python interface of ANSA for automated model generation. It supports its user during the model buildup process and stores generated SMDmodels in a database so that they do not have to be reanalysed again in subsequent projects. This is why valuable time and computing power can be saved.

FEA BEGINS AT LAYOUT: CONVERTING ECAD PCB DESIGNS INTO SIMULATION-READY MODELS

Nikolaos Drivakos, Magdalini - Androniki Vasiladioti
BETA / Cadence, Greece

KEYWORDS –
ECAD, PCB, IPC2581, Electronics

ABSTRACT –
Accurate finite element analysis (FEA) of printed circuit boards (PCBs) is essential for predicting thermal, structural, and electromagnetic behaviour in modern electronic systems.

This presentation introduces a streamlined methodology for transforming ECAD PCB layouts into high-fidelity, simulation-ready models. Leveraging ANSAS ECAD importer tool we demonstrate how to bridge the gap between electrical design and mechanical simulation.

Key steps include deciding what level of simplification to use and meshing strategies that preserve design intent while ensuring simulation accuracy.

Session 9

THE SPDRM ECOSYSTEM AS A FOUNDATION FOR AI

Georgios Nikolaidis
BETA / Cadence

KEYWORDS –

ABSTRACT –
There is a growing demand to accelerate the product development cycle and reduce turnaround time by applying powerful tools based on AI and ML technology.
BETA CAE suite integrates AI-powered solutions across all stages --from early concept design to multi-disciplinary verification and optimization-- enabling faster decision-making.

However, the effectiveness of the current and any future AI/ML applications depends critically on the availability of large-scale, structured, and high-quality datasets with good diversity.

SPDRM, BETA's enterprise solution for Simulation Process, Data, and Resources Management, can play a pivotal role in the field. By orchestrating cross-application workflows and maintaining traceable, structured data pipelines, SPDRM is the foundation for scalable and effective AI/ML solutions.


Demo Sessions

Session 3E

[DEMO] PCB DROP TEST SIMULATION: MODELING AND SETUP IN ANSA

Thanos Papadopoulos

KEYWORDS –
PCB, Drop Test, JEDEC P111

ABSTRACT –
This demonstration showcases a complete and efficient workflow for conducting drop test finite element simulations Using the BETA Suite tools. The process is built around ANSA for pre-processing and META for post-processing, highlighting the seamless interaction between tools. A key focus is on ANSA's robust meshing capabilities, which enable fast and accurate discretization of complex geometries tailored to drop test requirements.

The workflow also features streamlined material assignment from a centralized database, integrated solver setup, and automated generation of simulation-ready models based on JEDEC P111 protocol. Post-processing is handled through META, offering specialized tools for evaluating impact behavior, stress distribution, and deformation patterns.

This demonstration emphasizes how the integration of these tools reduces manual effort, improves consistency, and accelerates the overall simulation process.

[DEMO] CHALLENGES AND SOLUTIONS IN MODELLING OF ELECTRONIC CONSUMER DEVICES

Haris Bezdemiotis
BETA / Cadence, Greece

KEYWORDS –
ANSA, Midsurface, Extruded, Cross Section, Quad Dominant Mesh

ABSTRACT –
The design of rail vehicles is crucial for optimizing performance, safety, and efficiency, especially as rail transport becomes more complex. This demo focuses on a use case from Stadler Rail AG, highlighting the application of advanced cross-section meshing techniques in their vehicle design process.

Participants will experience a live demonstration of this meshing approach, showcasing how it accelerates development cycles. By streamlining the modeling process, engineers can quickly iterate on designs with improved performance. This session is ideal for professionals looking to leverage advanced simulation tools for efficient rail vehicle development.

[DEMO] STREAMLINING LIGHTWEIGHT DESIGN: CAD-CAE SYNERGY

Serafeim Chatzimoysiadis
BETA / Cadence, Greece

KEYWORDS –
SubD, Optimization, retopology, casting

ABSTRACT –
Subdivision (SubD) surface modeling is increasingly adopted as an effective method for generating smooth, high-continuity surfaces based on coarse, low-count polygonal meshes. By applying a recursive subdivision process, the mesh is refined to approximate a continuous, curved limit surface. This approach offers localized, intuitive control over geometry, supporting rapid shape development and refinement. SubD surfaces can be seamlessly converted into FE models or NURBS-compatible formats, facilitating their use in CAD and CAE environments.

This methodology was initially introduced in ANSA version 24.x during its early stages. However, in the latest versions, the tool has matured, incorporating additional functionality and forming a specialized ribbon called Retopology. Its primary purpose is to manage complex meshes (whether derived from topology optimization results or 3D scans) and quickly generate smooth surfaces that can be exported to other modeling software.

The ribbon is mainly divided into two sections: Solid Components and Casting Parts.
In the Casting Parts area, we introduce a new tool designed for rib modifications, along with several specialized tools for rib checks and manipulation. In the broader Solid Component area, we demonstrate how to build control meshes for subdivision surfaces through use cases where this innovative technique provides a fast and high-quality solution for modeling.

Session 3F

[DEMO] ACHIEVE IMPROVED NVH PERFORMANCE FASTER THROUGH THE UNIQUE DIAGNOSTIC CAPABILITIES OF META 2025.1

Grigoris Kalampoukas
BETA / Cadence, Greece

KEYWORDS –
NVH, FRF Assembly

ABSTRACT –
META 2025.1 has introduced two new diagnostic results which are unique and can really speed up the root cause analysis process helping the user reaching an improvement of the NVH performance much faster.

The first diagnostic tool is the Expanding TPA functionality which comes as a simple request in FRF Assembly tool and practically extends the TPA to multiple levels at the same time. Having this defined, enables FRF Assembly to calculate the worst path from the response to the loads independent of how many components and connectors are intervened.

The second tool is related to the assessment of the influence of each of the modes of a component to the response which does not belong to that component. This can be very useful and can provide another means for improvement of the NVH performance.

[DEMO] REDUCED MODELS IN MODULAR RUN MANAGEMENT FOR NVH

Christos Moulkiotis*
BETA / Cadence, Greece

KEYWORDS
Modular Run Management, NVH, Reduced Models, Assembly

ABSTRACT
Determining the NVH characteristics of full-scale models Using conventional solvers, demands substantial computational effort. Even minor design changes require to rerun a full-scale frequency response analysis to verify whether the new concept meets regulatory and performance requirements, rendering the process time consuming and resource demanding.

To address this, various reduced-order modeling methodologies have been developed to significantly accelerate analysis speed without compromising result accuracy. By utilizing reduced models such as superelements, modal models, or FRF models, Component Mode Synthesis or FRF-Substructuring methods can be employed to rapidly predict assembly responses. These substructuring techniques provide a distinct advantage as engineers can modify only the affected components and immediately assess their impact on the responses of interest. Despite these benefits, managing and versioning the resulting datasets remains a complex, multi-parametric challenge.

To streamline the management and analysis of multi-component assemblies, ANSA provides a fully modular environment via DM/SPDRM and Model Browser. Within this framework, analysts can seamlessly create components and their design variants, generate reduced models with ease, store all relevant data in DM/SPDRM, and efficiently integrate them Using connectors to construct the assembly.

[DEMO] FREQUENCY RESPONSE ANALYSIS IN MBD SIMULATIONS

Evripidis Ntinas
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KEYWORDS –
MBD, FRA, Optimization

ABSTRACT –
Following the eigenvalue analysis capabilities introduced in previous versions, this demonstration highlights the newly implemented Frequency Response Analysis (FRA) in Kinetics. FRA enables users to determine how a mechanical system responds to harmonic excitation across a range of frequencies, revealing critical dynamic behaviors such as resonance, that are essential for understanding and improving system performance. The analysis is based on linearizing the system around an operating point, which can be either the equilibrium or initial conditions, allowing FRA to be performed for both Equilibrium and Initial Conditions simulations.

FRA requires the definition of input and output channels on selected markers. Two input types are available: a translational/rotational swept sine force, and a rotating mass representing a mass offset from the axis of rotation. Results are saved as tabular data, providing amplitude and phase information of the system's response over the specified frequency range.

In this demonstration, we use a washing machine model to perform FRA at the equilibrium position. After defining the input and output channels and setting the frequency range, we run the analysis and visualize the frequency response in META post-processor to evaluate system behavior. Next, we integrate FRA with a design optimization workflow, tuning the stiffness and damping of the suspension system. The optimization aims to shift the resonance peak away from the critical operating range, demonstrating how FRA can be leveraged not only to evaluate but also to improve system performance when combined with optimization.

Session 5E

[DEMO] NVH CONSOLE: COMPONENT PANEL THICKNESS AND SHAPE OPTIMIZATION

Grigorios Kalampoukas
BETA / Cadence, Greece

KEYWORDS –
NVH, Optimization, NVH-Console

ABSTRACT –
With the integration of Component Panel Thickness and Shape Optimization capabilities into the NVH Console tool, NVH CAE analysts can now perform advanced structural optimization in a streamlined and efficient process. This enhancement enables users to quickly assess and refine panel characteristics, optimizing both thickness and geometry to achieve targeted noise, vibration, and harshness (NVH) performance. These new features complement the already available connector properties and modal parameter optimization tool in NVH-Console.

A built-in screening method has also been introduced, allowing analysts to reduce the number of candidate design variables to a manageable set of the most significant ones, improving focus and computational efficiency. Sensitivity analysis is conducted to determine how each design variable influences a specific response throughout the design cycle.

The streamlined workflow significantly reduces the time and complexity traditionally associated with manual or multi-software optimization approaches. For NVH CAE analysts, this translates into faster design iterations, improved model accuracy, and enhanced ability to meet performance targets early in the development cycle. The result is not only improved acoustic and vibrational behaviour of components and assemblies but also potential material savings and overall vehicle refinement.

[DEMO] POST-PROCESSING OF MBS RESULTS IN META

Markus Herbst
BETA / Cadence, Greece

KEYWORDS –
MBS, Flex Bodies, Post-processing

ABSTRACT –
Multibody System (MBS) dynamics plays a vital role in mechanical development, particularly in the automotive sector, where it is used to simulate vehicle dynamics behaviour during driving manoeuvres. The integration of flexible bodies in simulations enhances accuracy but introduces computational complexity due to the increased number of degrees of freedom (DoF). This challenge necessitates advanced numerical methods and higher computational power for both simulation and post-processing.
This demonstration presents an efficient approach to addressing these challenges by leveraging Epilysis as a solver for the flexible body modal content stored in MNF and OP2 files and META as a post-processor for MSC Adams simulation results.
First, various options are discussed how to decrease the number of DoFs in the Adams simulation while preserving the integrity of detailed flexible body results in post-processing. The basic idea to use light display models in the MBS solver and detailed models of the flexible bodies in the analysis phase in META. It will be demonstrated how the entire vehicle can be post-processed as well as how a dedicated analysis of single flexible bodies can be achieved through specialized tools in META. Beyond displacement results, stress results for flexible bodies and modal energy participation factors are analysed. Additionally, the visualization of 3D transient results and of complex modes obtained from Adams frequency analysis is showcased, highlighting an integrated workflow for accurate and efficient vehicle dynamics evaluation in BETA CAE software.

[DEMO] SQUEAK AND RATTLE ANALYSIS IN ANSA AND META

Christos Moulkiotis*
BETA CAE Systems S.A, Greece

KEYWORDS
Modular Run Management, NVH, Reduced Models, Assembly

ABSTRACT

Determining the NVH characteristics of full-scale models Using conventional solvers, demands substantial computational effort. Even minor design changes require to rerun a full-scale frequency response analysis to verify whether the new concept meets regulatory and performance requirements, rendering the process time consuming and resource demanding.

To address this, various reduced-order modeling methodologies have been developed to significantly accelerate analysis speed without compromising result accuracy. By utilizing reduced models such as superelements, modal models, or FRF models, Component Mode Synthesis or FRF-Substructuring methods can be employed to rapidly predict assembly responses. These substructuring techniques provide a distinct advantage as engineers can modify only the affected components and immediately assess their impact on the responses of interest. Despite these benefits, managing and versioning the resulting datasets remains a complex, multi-parametric challenge.

To streamline the management and analysis of multi-component assemblies, ANSA provides a fully modular environment via DM/SPDRM and Model Browser. Within this framework, analysts can seamlessly create components and their design variants, generate reduced models with ease, store all relevant data in DM/SPDRM, and efficiently integrate them Using connectors to construct the assembly.

[DEMO] MINIMISE TURNAROUND CALCULATION TIME FOR INTERIOR & EXTERIOR ACOUSTIC RESPONSES THROUGH ELEVATED REDUCED MODELLING CAPABILITIES OF META 2025.1

Christos Moulkiotis*
BETA / Cadence, Greece

KEYWORDS
Modal Frequency Response, Frequency Based Substructuring, Assembly, Reduced Models

ABSTRACT

META streamlines the analysis of multi-component assemblies by providing a Frequency Based Substructuring (FBS) method through its FRF Assembly tool. The tool calculates vibroacoustic frequency responses at the assembly level by exploiting the dynamic properties of reduced-order components, which are interconnected through connectors.

The FBS capabilities of META have been further enhanced with Nastran-based external superelements (SE) as source of dynamic information of components, which can be used to calculate responses and modal contribution analyses. The introduction of external superelements in FRF Assembly further enhances the ability to develop hybrid models, integrating modal-based components such as superelements and modal models, with experimental FRF components.

Furthermore, exterior acoustic responses can be calculated according to the Rayleigh integral method. Complementary tools for generating external field points to compute the noise emission have also been developed and are fully integrated with the tools.

Finally, the FRF Assembly now incorporates a newly introduced bush connector, enabling the definition of a complete stiffness and damping matrix. This enhancement expands the capabilities beyond traditional bush connectors by enabling the specification of dynamic properties between different degrees of freedom within the same connector

Session 5F

[DEMO] UNIFORMITY & INTUITIVENESS: THE NEW ANSA UI

Dora Zacharopoulou
BETA / Cadence, Greece

KEYWORDS –
ANSA, UI/UX, Efficiency, Performance, Productivity

ABSTRACT –
The evolution of simulation software is driven by the need for efficiency, ease of use, and user engagement. This demo will showcase the latest advancements since ANSA v25, a revolutionary update designed to streamline workflows, enhance usability, and optimize performance.
Through function consolidation, interface redesign, and direct editing capabilities, users can now work 50% faster while experiencing an intuitive and engaging environment.
The session will highlight key improvements such as ribbon customization, contextual tools, enhanced database browsing, and simplified command execution, ensuring that engineers can focus more on their designs and less on navigating through complex menus.

[DEMO] ELEVATED USER EXPERIENCE AND INCREASED PRODUCTIVITY WITH THE NEW META GUI - TIPS & TRICKS FOR A SMOOTH MIGRATION

Antonis Perifanis
BETA / Cadence, Greece

KEYWORDS –
META, GUI, migration

ABSTRACT -
The redesigned META interface significantly enhances post-processing workflows, increasing productivity and improving the user experience for both experienced users and newcomers.

Key features include a newly introduced ribbon interface that offers quick access to frequently used functions, and a database browser that enables efficient access to and organization of entities. These additions align the design more closely with ANSA, ensuring a consistent and unified user experience across both platforms. Additionally, automation capabilities through templates accelerate the result reading process, enhancing speed and efficiency.

The interface also adopts a workflow-oriented, procedural structure by grouping discipline related tools—such as NVH, Crash, and others—into dedicated sections, supporting more cohesive and focused operations. Moreover, users can tailor their working environment by selecting from various layout options, which adjust the visibility of ribbon tabs and context menus to suit specific needs.

These enhancements collectively support a smoother transition for existing users and provide a more intuitive experience for new ones, reinforcing META's role as a powerful and adaptable post-processing solution.

[DEMO] STREAMLINING SIMULATION PROCESSES: FROM MESH TO RESULTS IN NO TIME

Georgia Dimopoulou
BETA / Cadence, Greece

KEYWORDS –
ANSA, META, EPILYSIS, Efficiency, Productivity

ABSTRACT –
This demo session highlights the improved workflow efficiency introduced in ANSA v2025.1, enabled by its redesigned interface.
The session walks through the setup of basic static, modal, and frequency response simulations, emphasizing how the structured workflow helps guide users step by step through model preparation.
META is also featured, showcasing its updated interface which enables the user to easily access the most common used functionality.
Leveraging this revamped BETA CAE software suite, users benefit from a unified, efficient solution that ensures faster, error-free model setup, making everything more accessible, intuitive, and streamlined.

[DEMO] MODEL DEBUGGING AND INTEGRATION USING THE RUN SOLVER TOOL

Spyros Tsekouras, Ioannis Nerantzis
BETA / Cadence, Greece

KEYWORDS –
Job submission, model debug

ABSTRACT –
The Run Solver tool within ANSA serves as a specialized utility designed to facilitate the job submission of ready-to-run models for multiple solvers. A significant bottleneck in simulation workflows is the identification and resolution of model-related errors and integrity issues. This tool streamlines the model debugging process by enabling the immediate detection of common issues, including poor element quality, contact inconsistencies, and singularities. Furthermore, it supports early identification of potential convergence problems through real-time monitoring of solver-generated output files, thereby providing analysts with timely indicators of anomalies during the solution process.
The demonstration session will focus on the intuitive identification and systematic resolution of model-related errors encountered during the solution phase. It will be structured in two parts:
• The first part will highlight typical model integrity issues observed during static analysis Using the Epilysis solver.
• The second part will address contact inconsistency errors arising in static analysis scenario utilizing the Abaqus solver.

Session 6D

[DEMO] STATISTICAL ENERGY ANALYSIS (SEA) IN ANSA: MODEL PREPARATION, LOADCASE SETUP, VALIDATION AND SOLUTION

Theocharis Klotsikas*, Spyridon Vergos*
BETA CAE System, Greece

KEYWORDS –
SEA, NVH

ABSTRACT –
Statistical Energy Analysis (SEA) is a method particularly well-suited for rapid system-level response predictions during the early design stages of a product, as well as for predicting responses at higher frequencies. SEA equations are derived by (a) splitting the system into subsystems and (b) making specific statistical assumptions about the local dynamic energy content of each subsystem. These assumptions significantly simplify the analysis, enabling the examination of systems that are often too complex to analyse Using other methods, such as Finite Element (FE) or Boundary Element Methods (BEM).
SEA was introduced in ANSA in version 24, with additional features and capabilities incorporated in subsequent versions. Leveraging ANSA's powerful meshing capabilities, it is possible to set up a fully SEA-ready model from CAD and/or FE data. The robust process, along with in-house tools and checks, ensures a faster workflow and preparation.
Recent enhancements cover most aspects of modelling and boundary condition creation through easy and straightforward steps. SEA models in .XML format can be imported, edited and outputted as ready-to-run models for external SEA solvers.
Since version 25, an SEA solver has been integrated within ANSA, allowing for SEA analysis and results visualization within the ANSA environment. Initially, this solver can be used for validating simple results and checking model validity for SEA analysis. The latest enhancements of the solver will be presented as well as the comparison with other commercial SEA solvers.

Session 6E

ENRICH ANSA RESULTS MAPPER WITH WIDER RANGE OF RESULTS BY EXPLOITING META ADVANCED CAPABILITIES

Ioannis Nerantzis
BETA / Cadence, Greece

KEYWORDS –
results mapper, META, ANSA, metadb

ABSTRACT –
Engineering a product from concept to production usually involves application of several CAE simulation methods. Specific components may need to be modelled for CFD, NVH, Durability, Stamping, Crash etc. The modelling specifications of each simulation domain may impose different FE representations such as element types and mesh densities. During this process, it is very often that results of one simulation is the starting point of another. The process of transferring data usually involves multiple steps of parsing, processing, conversion and interpolation.

This demonstration showcases a new feature of Results Mapper tool that enables direct access to solver files containing simulation results. This is achieved by running META as a background process to read and register data as a source for the mapping process. META is well known for the powerful capabilities of reading and processing results for a variety of solver formats. Data labels are scanned, categorized according to their quantity type: scalar, vector or tensor, and may be transferred to the target model as initial conditions. Temperature, pressure and stress results can be directly interpolated and applied on the target mesh as initial conditions. Generation of RESULT auxiliary entities is also available for preview and further processing by scripting.

[DEMO] FATIQ: A ROBUST FATIGUE ANALYSIS TOOL FOR WHOLE-VEHICLE APPLICATIONS INCLUDING WELDED COMPONENTS

Ioannis Karypidis
BETA / Cadence, Greece

This demo will highlight the capabilities of FATIQ in terms of fatigue analysis for a full assembly.

First, the model set up will be demonstrated by highlighting the capabilities for fast material assignment to the components of the assembly based on advanced filtering rules.
Then, the model will be analysed for its base material and welded locations highlighting how several analysis types can be handled under the same task.

Finally, further examples will be demonstrated, illustrating the expansion of FATIQ to further fields of application such as thermomechanical or multiaxial fatigue analysis.

[DEMO] THE SEAMWELD CONFIGURATOR

Kosmas Gourgounis
BETA / Cadence, Greece

KEYWORDS –
Assembly, Seamwelds

ABSTRACT –
The increasing number of different fastener types and the different methods, technologies and materials used to assemble mechanical systems and components results in an enormous challenge for CAE related applications.
The situation gets even more complicated when taking into account the huge diversity of the fem representation of assembly items such as spotwelds, adhesives, weldlines etc related to the analysis type, solver, damage prediction, fatigue, etc

ANSA has integrated a huge number of solver dependent and independent fem representation for all supported fastener types.
However a large number of CAE engineers require additional settings and options on already existing solutions or require a completely new representation.

BETA CAE answers to this challenge with the integration of a Generic Seamweld representation,. This new approach allows the user to design and customize the welding representation as per the individual modelling guidelines.

Moreover an interactive panel, including a life preview of weld, which guides the user in setting up all individual characteristics and options of the fe entities to be generated.

The realization of mesh dependent weldlines and in particular the areas where the welds and their heat affected zones are crossing each other is also a case where the generated mesh pattern did not
meet the users expectations and quality requirements.
The Generic Seamwelds, once defined and realized in one step, are generated as one entity which drastically increases the quality of the outcome.

The new Generic Seamweld ensures an increase in performance and mesh quality for multiple welding cases and will set the standards for future development with respect to other fastener types such as bolts, rivets etc

Session 6F

[DEMO] HBM HANDLING IN ANSA AND META

Savvas Kelidis
BETA / Cadence, Greece

KEYWORDS –
Scaling, Landmark, HBM, Positioning

ABSTRACT –
This workshop offers a comprehensive overview of Human Body Model (HBM) handling Using ANSA and META, focUsing on key tools and techniques for both pre- and post-processing workflows. In ANSA, participants will explore the use of the Articulation Tool for realistic HBM positioning, Landmark Positioning for anatomical accuracy and consistency, and the Scaling Tool for adjusting models to match specific anthropometric data. Moving into META, the session will cover HBM post-processing techniques, including kinematic analysis, and injury metric evaluation. Through practical demonstrations attendees will gain valuable hands-on experience to efficiently prepare, analyze, and validate simulations Using HBMs. This workshop is ideal for professionals involved in vehicle safety, biomechanics, and virtual occupant modeling

[DEMO] EFFECTIVE STRATEGIES FOR MANAGING CRASH MODELS IN ANSA

Manos Dagdilelis*, Thanassis Fokylidis

BETA / Cadence, Greece

KEYWORDS – Crash, Safety, Includes, Lists, Checks

ABSTRACT –
This live demo is a follow-up to the presentation on the latest developments in Crash and Safety analysis. We will demonstrate both general and specialized techniques during the process of transferring entities from an include file of one full vehicle model to an include file of another one and the final output of a new study version of it. This scenario requires careful attention to preserve the integrity and existing rules of both models while moving entities between them.

The demo will showcase key ANSA tools designed to streamline this process, including multi-model parallel handling, the clipboard tool, model merging, numbering rules, ID management, ANSA's input/output capabilities, property replacement, the ANSA checking machine, updated Includes List, context menus, and more.

Attendees will gain insight into an efficient approach for routine Crash case management and understand why ANSA serves not only as a daily-use tool but also as a reliable drop-in replacement for any pre-processor in Crash analysis workflows.

REFERENCES

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[DEMO] ANSERS - A WEB TOOL TO VISUALIZE AND SHARE CRASH AND SAFETY RESULTS

Nikos Tsartsarakis
BETA / Cadence, Greece

KEYWORDS –
ANSERS, Crash and Safety, Data Management, User Toolbars

ABSTRACT –

Managing and communicating simulation data remains a major challenge in modern CAE workflows, especially when collaboration across simulation, testing, and design teams is needed. Traditional static reports limit accessibility and hinder understanding of results. This paper presents ANSERS, a web-based front-end application for visualizing and sharing simulation data through interactive dashboards. Integrated with META post-processing tools for Crash and Safety, ANSERS leverages automated extraction and storage of key outputs—such as time-history curves, scalar metrics, images, animations, and 3D model data—into a centralized or local data management system. The process requires no manual setup or custom scripting, and supports easy inclusion of custom results.
Data can be accessed directly in a web browser. ANSERS provides ready-to-use dashboards for standard evaluations, such as occupant injury criteria and pedestrian safety, and allows easy creation of role-specific views—from detailed technical dashboards to executive summaries. It also enables seamless sharing of live, interactive visualizations across teams.
Additionally, ANSERS supports integration with physical test data from SQL databases, ASAM-ODS systems, and standard file formats, enabling correlation studies and closing the loop between simulation and validation. This fosters more agile, transparent, and collaborative use of simulation data.

Session 7E

[DEMO] THE ALL-NEW CAD TO CAE WORKSPACE: BUILDING AND MAINTAINING SIMULATION STRUCTURES WITH EASE

Spyros Tzamtzis
BETA / Cadence, Greece

KEYWORDS –
KOMVOS, CAD, CAE

ABSTRACT –
In order to keep up with a rapidly evolving engineering landscape, CAE teams seek to improve the efficiency of their workflows and reduce the time to market. The integration of CAD and CAE is a longstanding challenge and a critical aspect of model build. At its core lies the need for a robust and effective bridge between design (PDM/PLM systems) and simulation (SDM systems/CAE tools) that will enable the definition of streamlined workflows for the extraction of CAD data and the seamless creation of CAE structures.
The digital mock-up (DMU) is organized in sub-assemblies considering several factors, that balance both engineering and manufacturing considerations. However, in most cases, the organization of the DMU is not well suited to CAE models and therefore, the classification of CAD parts into CAE modules plays a pivotal role in the CAE model build turnaround time. The differences in modularization between CAD models and CAE sub-assemblies necessitate a mapping process between the DMU structure and the CAE modules.
This demonstration showcases the all-new CAD to CAE workspace in KOMVOS. It features distinct, yet integrated sections for the management of CAD and CAE structures, and an interactive model viewer. With functionality that enables the detection of carry-over Parts; the creation of CAE structures from scratch or with the use of mapping tables; the manual or rule-based distribution of PLM groups to CAE Subsystems, it serves as the starting point for the streamlined transition from CAD to CAE structures for optimized product development.

[DEMO] PART BUILD ORCHESTRATOR: STREAMLINING THE PATH FROM CAD TO MESH

Pavlos Floratos, Ioannis Charalampidis

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KEYWORDS –
KOMVOS - SPDRM, centralized management, ANSA "workers" parallel processing, meshing on server, ML-assisted part classification

ABSTRACT
The integration of the Part Build Orchestrator plug-in within the KOMVOS and SPDRM platforms introduces a robust framework for the centralized management of simulation data and process execution. By leveraging a distributed architecture of ANSA "workers", the system enables efficient parallel processing for tasks such as meshing on server, significantly accelerating simulation preparation workflows. Additionally, the solution incorporates ML-assisted part classification, enhancing automation and consistency in part handling and simulation setup. This orchestrated environment not only streamlines complex CAE processes but also provides scalability and traceability, setting a new standard for high-performance engineering simulations.

[DEMO] ENHANCING RAIL VEHICLE DESIGN THROUGH ADVANCED CROSS SECTION MESHING

Haris Bezdemiotis
BETA / Cadence, Greece

KEYWORDS –
ANSA, Midsurface, Extruded, Cross Section, Quad Dominant Mesh

ABSTRACT –
The design of rail vehicles is crucial for optimizing performance, safety, and efficiency, especially as rail transport becomes more complex. This demo focuses on a use case from Stadler Rail AG, highlighting the application of advanced cross-section meshing techniques in their vehicle design process. Participants will experience a live demonstration of this meshing approach, showcasing how it accelerates development cycles.

By streamlining the modeling process, engineers can quickly iterate on designs with improved performance. This session is ideal for professionals looking to leverage advanced simulation tools for efficient rail vehicle development.

[DEMO] WORKING WITH COMPLEX PLASTIC PARTS MADE EASY

Dimitris Mavropoulos
BETA / Cadence, Greece

KEYWORDS –
Middle extraction, Casting

ABSTRACT –
Casting is a fundamental manufacturing process in metal or plastic complex geometries and large-scale components.
Advances in casting functionality allows to complete a whole middle creation process, starting with the 1st result improvement up to the design change handling, hybrid modelling and Partitioning.

Session 7F

[DEMO] OPTIMIZING WORKFLOW WITH ANSA AND FIDELITY AUTOSEAL FOR MESHING, MODELING AND SIMULATION SET UP FOR FIDELITY CFD

Vangelis Skaperdas
BETA / Cadence, Greece

KEYWORDS –
ANSA, Watertight, CFD, AutoSeal, Fidelity CFD

ABSTRACT –
Detecting and closing leaks for complex external aerodynamics simulations of complex automotive geometries is a challenging task that involves a lot of man hours. The functionality of ANSA is now enhanced with the integration of Fidelity AutoSeal, minimising the effort to generate a watertight model ready to be used for surface wrapping of octree Hextreme volume meshing.

In addition, ANSA now fully supports the GPU-accelerated Fidelity CFD solver, providing native mesh I/O and all the tools needed to effortlessly setup a complete CFD simulation.

This live demonstration showcases the use of three main tools in ANSA:

The Isolate>Visibility Groups function to extract the exterior wetted surfaces

The Autoseal function to automatically detect and seal all leaks of the geometry

The Setup FidelityCFD Case function to setup the solver numerics, boundary conditions, materialsm solution monitors and more, in order to have a ready to output and run full CFD simulation, all from inside ANSA.

[DEMO] COUPLING THE ANSA SPH SOLVER WITH CFD SOLVERS

Stelios Kanellopoulos
BETA / Cadence S.A

KEYWORDS –
SPH, CFD, coupling

ABSTRACT –
Smoothed Particle Hydrodynamics (SPH) offers a robust, mesh-free approach for simulating complex fluid dynamics, making it particularly valuable in the automotive industry where free-surface flows, multiphase interactions, and dynamic boundaries are common.

This demonstration will walk through the basic setup of the ANSA SPH solver, including particle initialization and particle source strategies. The session will then focus on the coupling of the SPH solver with traditional grid-based CFD solvers to create hybrid models that combine the strengths of both methods.

Through real-world automotive examples—such as fuel sloshing in tanks, water wading simulations, and thermal management gearboxes—we will showcase how SPH-CFD coupling enhances simulation fidelity and flexibility.

[DEMO] META'S BREAKTHROUGH IN CFD POST-PROCESSING EFFICIENCY

Chatzivasiloglou Efi
BETA / Cadence, Greece

KEYWORDS –
CFD, post-processing, Ribbon interface, workflow optimization, productivity

ABSTRACT –
This demonstration introduces users to the revolutionary post-processing capabilities in META through the newly implemented Ribbon interface. The enhanced workflow addresses long-standing challenges in computational fluid dynamics (CFD) post-processing by providing a streamlined, intuitive approach that significantly reduces complexity while improving efficiency.

[DEMO] ANISOTROPIC CFD MESHING FOR AEROSPACE AND MOTORSPORT APPLICATIONS

N. Christodoulou
BETA / Cadence, Greece

KEYWORDS –
CFD, Aerospace, Motorsports, Anisotropic mesh

ABSTRACT –
Aerospace and Motorsport industries are pushing the boundaries of CFD, having to manage meshes that constantly increase in element count and complexity. However, larger meshes lead to a rapid increase in computational resources and do not always meet the accuracy targets. High-fidelity simulations require meshes that satisfy demanding quality criteria, refine areas of high interest and ensure smooth transition in element sizes.

BETA / Cadence has developed a series of tools that generate best-in-class meshes which meet the Solvers quality standards and ensure the robustness of the CFD process.
This demonstration presents the methods used to create High-fidelity Anisotropic meshes that can be used for Aerospace and Motorsport models. The workflow includes the identification of critical areas as the Leading and Trailing edges, assignment of tailored mesh settings and detailed checks for Quality control.

Session 8E

[DEMO] BEYOND ASSEMBLY: MASTERING MODEL HIERARCHY, CONNECTIONS, AND PENETRATIONS WITH CUTTING-EDGE NAVIGATION

[1]Zafeiria Kanellia*, [1]Nick Economidis, [2]Georgios Nikolaidis, [1]Evangelos Parlantzas, [1]Michael Tryfonidis, [1]Mikes Tsampounaris

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KEYWORDS –
Parts navigation, welds navigation, check penetration, penetration navigation

ABSTRACT –
This demo showcases the enhanced capabilities of ANSA's Navigate tool, developed to streamline the management of connections and weld validations across various use cases. At its core, the tool offers robust navigation functionality via a contextual ribbon and introduces accept/reject workflows that improve communication and support more effective decision-making. Users can now navigate connections individually, leveraging both existing and newly developed features within the Assembly Navigate environment. The tool also supports symmetric parts, enables both interactive and automatic reporting, allows for annotation creation, and offers the flexibility to extend functionality through scripting. Key use cases include seamline checking—Using the enhanced Check > Connections draw mode with new sub-checks, auto-fixing, and automatic updates triggered by actions in the ANSA graphical area. Penetration analysis is handled through the dedicated Penetrations Navigate mode, powered by the Penetration > Parametric codebase. This includes parts-based clustering of interpenetrated areas, a dedicated check draw mode, and a specialized navigation ribbon. Both automatic and manual fixes are supported, with real-time updates applied directly within the graphical interface. These developments significantly improve model readiness, reduce the likelihood of errors, and save time throughout the weld design and validation workflow. The result is a more robust, adaptable, and user-friendly approach to managing complex assembly scenarios in ANSA.

[DEMO] EFFICIENT AND FAST COMPARISON OF MULTIPLE MODELS IN META

Karypidis Ioannis
BETA / Cadence, Greece

This demo will include various tips & tricks about comparing results of multiple simulation variants in META.

Firstly, it will present some capabilities how to handle multiple models in a single or multiple windows, synchronize animation and view, search for similar items in all models, identify and calculate differences between their model and results data.

Then, it will display how various automation tools (templates, METADB projects, sessions) can be used to standardize a process and facilitate comparison. The concept of each approach will be explained analysing its benefits and drawbacks.

[DEMO] REPORTING IN META: UNLOCKING THE POWER OF REPORT COMPOSER

Georgios Michailidis
BETA / Cadence, Greece

KEYWORDS –
META, Automation, Post-processing

ABSTRACT –
This demo provides an in-depth look at META's advanced reporting capabilities, focUsing on tools that enable the creation of dynamic, interactive, and reusable engineering reports. Using Report Composer, built-in functions, and different export options, attendees will be guided through a complete workflow, from simulation results to professional-grade reports. The demo will focus on creating a structured report Using a pre-configured PowerPoint template, including image and text placeholders, tables with built-in functions, and variable fields. Key features include auto-updating tables and dynamic content generation. Additionally, the session will cover how to export and integrate 3D content: linking an interactive HTML3D report into PowerPoint, exporting the model as a GLB file for embedded 3D viewing, and including a Meta Viewer object to open a METADB file interactively within the report.
This session will showcase both well-known and powerful yet lesser-known features of META that can greatly improve reporting efficiency, enhance automation, and elevate presentation quality.
Key Highlights:
• Building smart, branded reports Using templates and placeholders
• Auto-updating tables with built-in functions and live data links
• Drag-and-drop content placement via Report Composer
• Metadata and variable substitution for consistency and automation
• Embedding 3D content in reports, including HTML3D, GLB, and Meta Viewer objects

[DEMO] SIGNIFICANTLY REDUCED STORAGE REQUIREMENTS THROUGH AUTOMATED & EFFICIENT COMPRESSION OF RESULTS USING METADB TRANSLATOR

Nikolaos Tsartsarakis
BETA / Cadence, Greece

This demo introduces the METADB Translator, a tool developed to convert solver output files into the efficient METADB format Using configurable compression settings. By applying tailored compression during translation, the tool significantly reduces file sizes while preserving essential simulation data needed for post-processing. This improves data handling efficiency and accelerates loading times within the META environment. This session will demonstrate how users can configure compression parameters, define the necessary inputs effectively across supported solver outputs, and typical use cases, highlighting how the MetaDB Translator streamlines data management and enhances performance in simulation workflows

Session 8F

[DEMO] THE NEW EASY WAY TO STORE AND SHARE RESULTS USING META AND ANSERS

Antonis Perifanis
BETA / Cadence, Greece

KEYWORDS –
META, ANSERS, web visualization, data sharing

ABSTRACT -
The demo consists of two parts. The first part will demonstrate how reports like images, videos, key values, curves and 3d models can be stored from META to SPDRM or filebased DM system Using the newly developed User Interface in META. The functionality renders the process to save data to DM much faster and more intuitive.
The second part will describe the new approach to set up web dashlets to visualize the stored reports in ANSERS Using the ready-to-use library items available with the software. Furthermore, examples will be given how new reports can be added and updates to existing ones can be handled with the new capabilities.
Finally, various scenarios of sharing the visualized reports with other users or groups will be presented.

[DEMO] STREAMLINE OF PRE & POST-PROCESSING OF OIL CANNING LOAD CASES

Arsenis Zoumpourlos
BETA / Cadence, Greece

KEYWORDS –
oilcanning, loadcase, durability

ABSTRACT –
A typical Oil Canning analysis starts with the identification of the critical points through a linear static or normal modes analysis. In the next step, a nonlinear static analysis is performed on those critical points for the durability evaluation of panel areas. This process is assumed to be a time-consuming task since it requires repeating the same steps for numerous points in the exterior parts of a vehicle.
The tool, developed to overcome these challenges, aims to accelerate the process by eliminating the huge number of iterations and automating the pre and post-processing modeling steps such as the device positioning and final report of critical points.

[DEMO] SIMPLIFYING SHELL MODELS TO BEAMS: SPEED, ACCURACY, AND HIGH DESIGN FLEXIBILITY

Nikos Efstathakis*, Vasilis Evangelou
BETA / Cadence, Greece

KEYWORDS –
Beam Modelling, Beamify Structure, Connect Beams

ABSTRACT –
A practical demonstration is carried out on the cockpit structure of racing car, where an existing shell finite element model is converted into a pure beam model. Identical load cases are applied to both configurations, enabling a direct comparison of structural response and modeling efficiency.
The process highlights ANSA's powerful and intuitive tools, such as the automatic recognition of beam-like structures and the connection of the resulting beam chains into a continuous structural network. These functionalities significantly simplify the conversion process, while preserving the essential structural behavior despite the substantial reduction in computational cost.
A comparative evaluation of the simulation results is carried out to assess the accuracy of the beam model relative to the original shell-based one. Beyond performance and correlation, the beam model is further analyzed from an engineering standpoint to demonstrate the added value it provides, like enhanced flexibility, parametric control and improved insight into the structural behavior of the system.
This work highlights that, even in an era of high-performance computing, well-constructed beam models retain significant advantages for specific structural applications. Beyond faster solution times and comparable accuracy, pure beam models offer a high degree of customization flexibility—enabling engineers to efficiently explore design alternatives, adjust cross-sectional dimensions or materials, and rapidly assess their impact without the need for remeshing or complex redefinition of the model. These capabilities make beam modelling not just a lightweight alternative, but a powerful and adaptable approach for iterative design, optimization, and early-stage development, without being limited to it.

[DEMO] FROM DATA OVERLOAD TO ACTIONABLE INTELLIGENCE: ANSERS' REVOLUTION IN CFD REPORTING

Chatzivasiloglou Efi
BETA / Cadence, Greece

KEYWORDS –
ANSERS, CFD, dynamic reporting, real-time visualization

ABSTRACT –
ANSERS is an innovative platform that transforms how simulation data is managed, processed, and communicated across engineering teams. ANSERS provides a versatile solution for multidisciplinary analysis, including Computational Fluid Dynamics (CFD), structural analysis, thermal simulations, multiphysics applications, and more. For this presentation, we will focus specifically on ANSERS' application to CFD workflows, where the complexity and volume of data present unique challenges.

CFD simulations produce particularly large datasets with complex visualizations that benefit significantly from ANSERS' automated processing capabilities. This integration automates the traditionally tedious task of model housekeeping, systematically structuring CFD results files according to specific product requirements while enabling dynamic visualization and collaborative analysis.

ANSERS moves beyond traditional post-processing approaches by providing a dynamic reporting environment where correlation images and plots automatically update based on selected simulation results. The platform enables engineering teams to create and share live reports that incorporate newly generated results and user updates without requiring specialized software expertise. This real-time interaction with simulation data represents a significant advancement over static reporting methods. The ANSERS platform serves as a centralized hub where CFD specialists, design engineers, and project managers can collaboratively analyze results, make informed decisions, and document findings. By streamlining the workflow from simulation execution to results communication, ANSERS significantly reduces cycle time while enhancing the quality and accessibility of complex CFD data across organizational boundaries.

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