FEA - CAE Not to Miss & More

October 2025 ISSN 2694-4707

Town Hall Meeting in the town that almost exists
Town Plaza: Drive slowly – Galloping Prohibited

Airport – Dubai

Airport - Malloy T150

Auto - UTCN

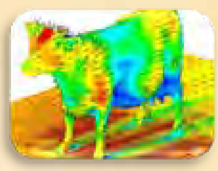
Racer - Mercedes

Marco - RBF

Madhukar - CADFEM

Metin - OZEN

Robin - Siemens



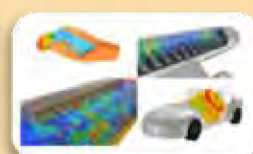
Abhinav - MyPhysicsCafe

Marta – OASYS

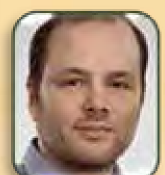
2-Day Intro to LS-DYNA Implicit 12/02/2025 (OnLine)

Mi&Ke – Nightly News

Jenson – DFE Tech

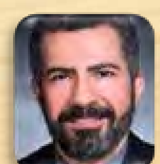


Markus - CADFEM



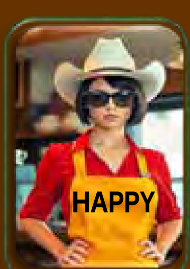
Tips 11-15

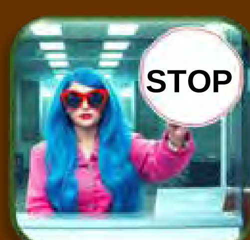
Maysam – Predictive



Brent – GOENGINEER

Marnie – Simpleware





Legal - the shortened version (it was too long to read)

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Editors: Anthony, Art, Marnie, Marsha, Sabyl

Town Pretend to be Editors:

The Old Rancher	No one in town knows his name. You yell "Hey, Old Rancher."
The Old Pilot	No one in town knows his name. You yell "Hey, Old Pilot."
The Old Racer	No one in town knows his name. You yell "Hey, Old Racer."
Racer's Daughter	The whole town knows her name. You yell "HEY, Slow down!"

They are all family - strange family

Names, & characters of AI visitors and AI editors are the products of imagination. Any resemblance to actual persons, living or dead, or actual events is purely coincidental.

We will always remember

FEANTM Town Always Salutes:

- Our US military, NATO and Friends of the US & NATO - First Responders, Police, Fire Fighters EMT's, Doctors, Nurses, SWAT, CERT Teams, etc.
- We salute engineers, scientists, developers, teachers AND students because without them we would not have technology.

USA & allies of the USA

Parking & Coffee are free.

R & D - Camping - Town Map

Horse Trail → Yield right of way to horses

R&D Technology Business Park

RV CAMPING
Park in any vacant camping site

CADFEM
OFETECH
d3View
OZEN
ENGINSOFT
AUTODESK
Oasys
DYNA MORE
DYNAlook
Ansys
Applus+ DatapointLabs
rescale
PredictiveEngineering

Town Hall & Library

Lawrence Livermore National Laboratory

rbf
MEDITATE
LIVGEMINI
rbf.LAB

The Old Rancher

Race Track

Airport

Sports Stadium

- **Logos represent companies/academia/research with solutions for today's world.**
- If you wish to have yours removed, kindly inform us at **feaanswer@aol.com**.
- Proceeds from the auction of your building will be allocated to the coffee budget.
- The map is subject to change - building sites will be rotated accordingly.

Table of Contents

Individuals are the persons we wish to thank. It doesn't imply association with a company.

Links provide the URL to the information.

October - Town Hall Meeting

The websites will have the complete information and high-resolution graphics

FEANTM – Outdoor Movie Theater Now Showing

Table of Contents

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Welcome to our County, Town Hall Meeting & Announcements

Town Motto: Creation is born from trying. If it doesn't work, learn & try again. You will succeed. Ideas, simulations, medical cures, creativity wouldn't exist without the passion to keep trying.

You've Got This

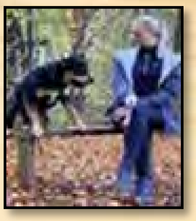
FEANTM Town Hall Meeting
"The town that almost exists"

Park cars behind the building
Park tractors behind the cars

Tie horse to the hitching rails

Bakery Cafe
Gossip, cookies. chocolate
Pets welcome.
Horses, pet goats stay outside
Technical solutions & information
Caring about animals and children

Announcements from residents not to miss



Marta: Don't miss our upcoming 2-Day (Online) Course.
Introduction to LS-DYNA Implicit Dec. 02, 2025.

Madhukar: Increasing the data rate of pressure pulses in hydraulic-mechanical systems such as valve units for drilling fluid in steerable drilling tool...

Metin: Discover how Fluent and Rocky coupling can be leveraged for efficient CFD + DEM simulations.

Marco: In this paper, an RBF mesh morphing-based method suitable for tackling generic CAE industrial applications is presented.

Marnie: Jajal Medical Svcs. use Synopsys Simpleware software to help convert patient scan data (such as from CT & MRI) into 3D STL & Finite Element models.

Jenson: Ansys Electronics (Crossed Dipole Antenna Near Field Simulation using Ansys HFSS) is to enhance skills in antenna design & electromagnetic simulations..

Abhinav: Composite fatigue is a critical challenge in the design & application of composite materials, which engineers must pay close attention to.

Maysam: There's nothing theoretical about a four-pound bird smashing into your multi-million dollar propulsion system at 200 knots. Bird strikes aren't just statistical risks.

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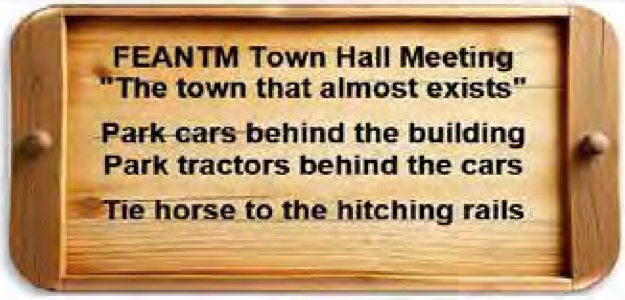

Our publication features a diverse mix of papers, articles and simulations from various fields. We strive to integrate new and interesting content for your enjoyment and learning.

Hello and once again welcome to our FEANTM October 2025 edition.

As usual, we have many stimulating articles for your perusal. Here are a few articles that caught my attention this month:

- For our sports enthusiasts, resident Adam shares an article by **Steffen Maier & Jörg Fehr** on motorcycle safety.
- Brent shares and article by **Jared Trotter** on what goes into making a golf ball. Who knew a golf ball could be so complex?
- The Airport – Aerospace – Military section has a link to **the upcoming Dubai Airshow.** Dubai is a great place to visit and the airshow sounds thrilling.
- The Old Rancher shares an article from **CapGemini** on the importance of Bees in our lives
- For some fun, browse through the Town Comic Blog Chronicles. The Comic Blog that showcases an entertaining array of characters and stories.

Thank you to all of our readers and contributors. We hope you enjoy reading FEANTM as much we enjoy sharing it with you.

Thank you for being part of the FEANTM+ community.
Best regards, Marnie B. Azadian, Ph.D., Managing Editor

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Tie horse to the hitching rails

Bakery Cafe
Gossip, cookies. chocolate
Pets welcome.
Horses, pet goats stay outside
Technical solutions & information
Caring about animals and children

Yes, it's true, I have my own announcement page. SO, join me as I drive my tractor around the internet and live in the town that almost exists. (located near Livermore, CA)

At our coffee meeting, we voted to raise the coffee budget!

(I agree that wasn't earth-shattering engineering news, but I also know it isn't a surprise to any of you out here.)

I have been teaching the ranch coyote about my space, coyote space, but there is an issue with where the boundary is. See my supervisor page 68, and you will see what I mean.

Users and students learning LS-DYNA know the importance of material models**. Now, grab your coffee and head to the library for this month's education on material models:**

Yury Novozilov "Collection of LS-DYNA material models"

I've failed at teaching the town birds to stay away from the airport and the plane engines.

The Real Cost of Bird Strikes and the Value of Simulation by Maysam Kiani

This morning, I asked the cows if they knew about CFD? Their answer, "MOOO, Cow Food Delivery." I replied, That's true, but it's also Computational Fluid Dynamics.

Aerodynamics of a Simcenter FLOEFD cow, by Robin Bornoff.

Sitting here with a Dubai chocolate bar will be as close as I can get to the November Dubai Air Show held under the patronage of **His Highness Sheikh Mohammed bin Rashid Al Maktoum**, Vice President and Prime Minister of the UAE, the Ruler of Dubai.

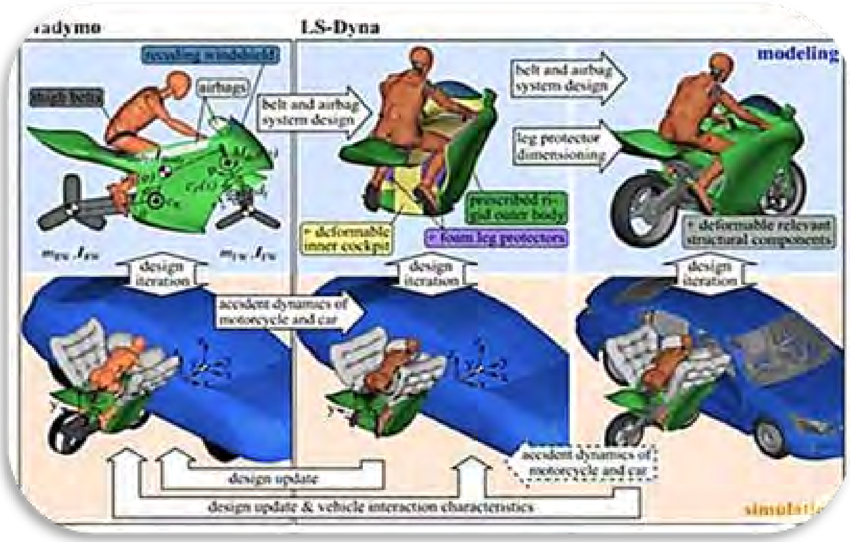
Head over to our airport and see some speakers Not To Miss, Dubai Air Show

And, of course, don't miss my good friends, Dr. Chat and Rheken, who keep this town that almost exists on our roadmap – not sure which direction that is, but it is a road.

Gotta love coffee, chocolate, demolition & rebuilds (and it burns calories)

Stage 1: The motorcycle as well as a rider surrogate are modeled in a combined MB and FE approach in the Madymo software environment (version MADYMO 2020.1) **Stage 2: The rider interaction surfaces of the motorcycle cockpit are modeled further detailed as an FE model in the LS-Dyna software environment** (version LS-DYNA R9.3.1 MPP)

Stage 3: The motorcycle, the already tuned passive safety systems equivalent to stage 1 and 2, **the rider surrogate, and an accident opponent are modeled as full FE representations in LS-DYNA.** The motorcycle's structurally relevant components that determine the crash behavior are deformable.



Springer - Web - Efficient simulation strategy to design a safer motorcycle

Steffen Maier & Jörg Fehr

Institute of Engineering & Computational Mechanics, Univ. of Stuttgart, Germany

stage 1: combined MB/FE model
stage 2: coupled FE/MB model
stage 3: FE model
development progress --------->
Modeling & simulation strategy

Abstract - This work presents models and simulations of a numerical strategy for a time and cost-efficient virtual product development of a novel passive safety restraint concept for motorcycles. It combines multiple individual development tasks in an aggregated procedure. The strategy consists of three successive virtual development stages with a continuously increasing level of detail and expected fidelity in multibody and finite element simulation environments. The results show what is possible with an entirely virtual concept study—based on the clever combination of multibody dynamics and nonlinear finite elements—that investigates the structural behavior and impact dynamics of the powered two-wheeler with the safety systems and the rider's response. The simulations show a guided and controlled trajectory and deceleration of the motorcycle rider, resulting in fewer critical biomechanical loads on the rider compared to an impact with a conventional motorcycle. The numerical research strategy outlines a novel procedure in virtual motorcycle accident research with different levels of computational effort and model complexity aimed at a step-by-step validation of individual components in the future.

1 Introduction - A motorcycle accident is a very complex event where the rider and the motorcycle interact with many environmental factors. Due to the exposed position of the riders, the vehicle itself does not provide protection to the rider in the event of a collision with an accident opponent or a roadside structure. Instead, violent ejection of the rider from the motorcycle is a likely accident pathway when the vehicle suddenly comes to a standstill [1–3]. When striking objects in their path and the ground, the consequences are often severe or fatal for the involved riders. This results in an excessive risk that motorcycles are 25 times more deadly per kilometer traveled than passenger cars…

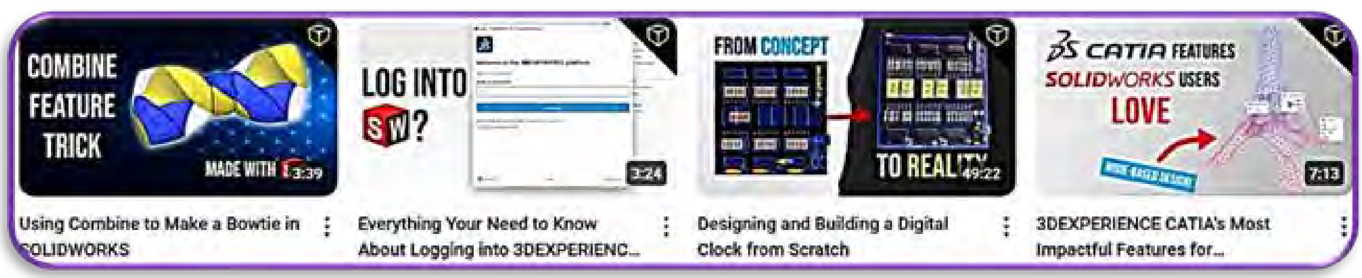
GOENGINEER Quote, “**Jared Trotter, applications engineer at GoEngineer, wanted to tackle creating a golf ball, so he turned to the 3DEXPERIENCE Platform.** On the Platform, he used 3D Pattern Shape Creator, which lets him create highly complex patterns much more simply than with traditional CAD.”

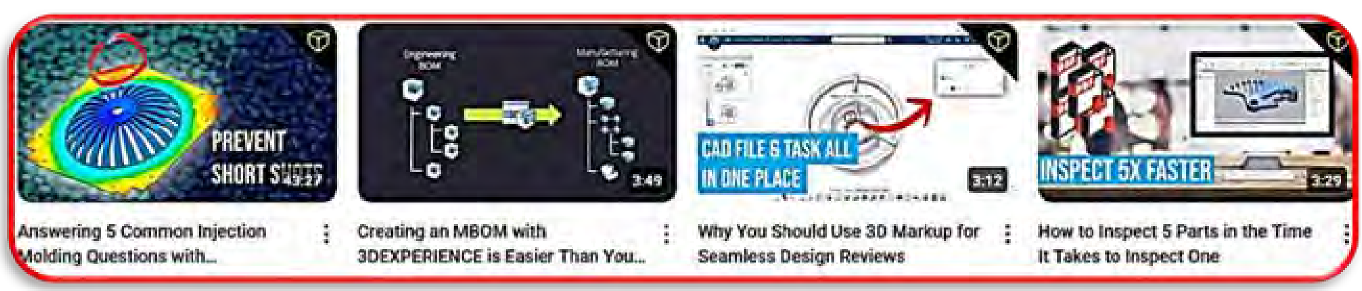
“Here, Jared walks you through his process step-by-step, explaining what went into his golf ball replication. What should he design next?”

YouTube – GOENGINEER - **[CAD Modeling Deep Dive: Making a Golf Ball]** - **Jared Trotter**

Have you ever looked closely at a golf ball? It seems simple enough, dimples patterned around the ball in an even spacing. But look closer. You'll notice that the pattern is actually a hexagon filled with circles. That makes replicating the pattern in CAD more than difficult; it's nearly impossible.

Additional videos available in the GoEngineer Channel





"LLNL researchers created molecular dynamics simulations to explain why either graphite or diamond forms when carbon crystallizes. **There's a reason why engagement rings are more expensive than wooden pencils. Diamond and graphite are both made of crystallized carbon, but diamond is much rarer"**

Web - LLNL - [When carbon crystallizes: molecular simulations reveal why graphite outshines diamond](#)
Ashley Piccone **(Picture LLNL researchers created molecular dynamics simulations to explain why either graphite or diamond forms when carbon crystallizes.)**

In a study published in Nature Communications, researchers including Margaret Berrens at Lawrence Livermore National Laboratory (LLNL) created molecular dynamics simulations to explain what material forms when carbon crystallizes. Their work reveals that graphite can spontaneously nucleate, despite diamond being the stable phase under the studied conditions, offering insight into why natural diamonds are so rare. Experiments to understand carbon crystallization have been inconsistent, with large discrepancies. The harsh conditions in which carbon crystallizes (pressures consistent with the Earth's interior) are difficult to achieve in the laboratory, and the transition happens very quickly.

To address that challenge, the authors developed accurate and efficient machine-learning potentials. They trained their model on density functional theory, which is a state-of-the-art quantum mechanical method used in condensed-matter physics.

With this model, the team could study thousands of atoms over the course of microseconds — well beyond the reach of conventional quantum simulations. When liquid molten carbon was cooled at constant pressure, they expected to see glassy carbon as a result. Surprisingly, they instead saw spontaneous crystallization. At higher pressures, diamond formed. At lower pressures, some of which should also form diamond, they instead saw graphite.

"Graphite crystallized even within the domain where diamond is most stable," said Berrens.

This counterintuitive result arises from the distinct nucleation pathways of graphite and diamond, with graphite's metastability and lower interfacial free energy favoring its formation even in the stability domain of diamond. More simply put: picture the diamond phase at the top of a shorter staircase and the graphite phase at the top of a taller staircase. The graphite is more difficult to get to. But now imagine the diamond staircase has huge steps, while the graphite staircase has steps that are more manageable. Because those intermediate steps are easier to get to, the carbon takes the path of least resistance, crystallizing into graphite instead of diamond under certain conditions.

Understanding the fine lines that separate graphite from diamond from liquid molten carbon is critical for modeling the interior of giant planets and achieving fusion ignition at LLNL's National Ignition Facility (NIF). "In experiments such as those at NIF, diamond is commonly used as the surface of the target capsule. During the initial phase of implosion, it is driven to melt and blow off, or ablate, as evenly as possible," said Berrens. "Understanding carbon crystallization near the graphite-diamond-liquid triple point is essential to ensure the transition remains controlled rather than chaotic to obtain high-yield shots." With this knowledge of carbon's behavior, the team also aims to help lay the correct mathematical foundations for hydrodynamic simulations of NIF capsule performance. This work was a collaboration with researchers at the University of California Davis and George Washington University.

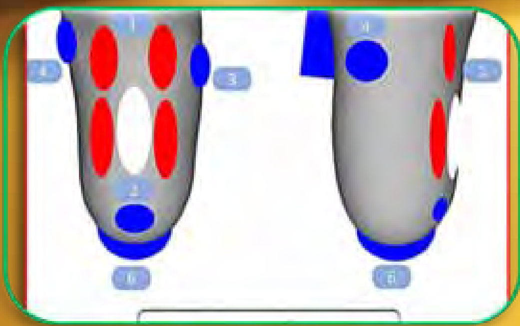
I love tractors, planes, drones, trains, military tanks. I do NOT love baking (I'm a baking disaster)

The ranch Coyote by the food pan and for

From previous issues not to miss!

LS-DYNA Stent Simulation is redefining cardiovascular innovation. Enabling high-fidelity virtual testing of stent behavior during critical stages like crimping and dilation - under realistic, physiological conditions. In biomedical engineering, stents play a crucial role in treating artery blockages and restoring blood flow.

Web - CADFEM AI - Advancing Cardiovascular Treatment: How LS-DYNA Powers High-Fidelity Stent Simulations - Suraj Dhomase



The aim of this work was to describe a novel process of generating a prosthetist-specific, digital "global" template and to illustrate that it can be automatically applied to rectify the shape of a transtibial residual limb.

Web – MDPI - Prosthetist-Specific Rectification Templates Based on Artificial Intelligence for the Digital Fabrication of Custom Transtibial Sockets - A.G. Cutti...

Website article by Jim Byrne, "Explore the physics behind the Olympic long jump, where speed, takeoff angle, and body mechanics combine in a perfect example of projectile motion. Learn how athletes use science and technique to maximize jump distance and outpace the competition."

Web – Autodesk - [The Long Jump: The Science of Projectile Motion Explained](#) - Jim Byrne

(*Left: Long Jump Championship: Professional Female Athlete Jumping on Long Distance. Determination, Motivation, Inspiration of a Successful Sports Woman Setting New Record Result. Competition on Big Stadium*.)

Track and field events are some of the most watched competitions in the Summer Olympics. The long jump stands out as both historic and technically demanding. Beyond raw athleticism, the long jump elegantly demonstrates the physics principle known as projectile motion. This complex motion dictates how athletes launch themselves into the air and land. A deep understanding of these mechanics can help optimize every centimeter of jump distance.

The approach: Building speed for effective projectile motion - Before a jumper even leaves the ground, the foundation for a great jump is laid in the approach run. In about 40 meters — typically 4 to 6 steps — the athlete builds a maximum controllable speed. Sprinters like Usain Bolt have clocked speeds near 28 mph in a 100-meter dash. However, jumpers may not reach these velocity extremes because their acceleration phase must align precisely with their takeoff timing.

The athlete's muscle composition also plays a significant role. Humans generally exhibit a balance between "fast-twitch" fibers. These produce rapid bursts of energy ideal for sprinting, and "slow-twitch" fibers, more suited for endurance. Top jumpers often have a higher ratio of fast-twitch fibers, enabling explosive power in their run-up and takeoff.

act as resistance, reducing efficiency. Coaches emphasize a neutral head and neck position, relaxed jaws, and slightly curved fingers to avoid unnecessary strain. Arms usually remain bent below 90 degrees to assist momentum without sacrificing balance or wasting energy.

Takeoff: The crucial launch phase - Once maximum manageable speed is attained, the next two steps set the stage for takeoff. The penultimate step is the longest stride, with the athlete lowering their hips to prepare for launch. The final step is carefully placed flat along the runway midline to minimize vertical movement and maximize forward momentum.

Standard physics might suggest a 45-degree takeoff angle offers the optimal balance of vertical and horizontal velocity to maximize jump distance. However, long jumpers do not follow this textbook ideal for two main reasons:

- Velocity and angle are interdependent: Unlike simple projectile theory where vertical and horizontal components are independent, jumpers experience a trade-off between speed and angle.
- Ground elevation difference: The landing area is approximately 50 cm lower than the takeoff board, shifting the ideal launch angle downward.

Research indicates the optimal takeoff angle for elite long jumpers lies between 15 and 27 degrees, clustering near about 22 degrees. This lower angle favors preserving horizontal velocity. This essentially trades some vertical lift for forward speed—the key to achieving greater distances.

As the athlete launches, arms swing forward to counter rotations generated by the powerful leg thrust, and the body's center of mass moves ahead of the feet. In mid-air, intentional cyclical arm and leg movements can resist forward rotation. This helps maintain body orientation and control flight trajectory for a longer leap.

Projectile motion physics: Breaking down the jump - Projectile motion is a classic physics concept describing the curved flight path of an object launched into the air, acted on only by gravity and its initial velocity components. The jumper becomes a projectile, propelled forward and upward with a speed and angle shaped by their physical capabilities and technique.

Projectile motion splits neatly into independent horizontal and vertical components. Horizontally, the jumper moves at a nearly constant speed (ignoring air resistance), while gravity acts vertically to pull them back to the ground.

Consider this simplified formula for the horizontal range RRR of a projectile launched at speed v0v_0v0 and angle θ\thetaθ:R=v02sin⁡2θgR = \frac{v_0^2 \sin 2\theta}{g}R=gv02sin2θ where ggg is the acceleration due to gravity (about 9.8 m/s^2). This formula calculates the ideal range on level ground, but the lowered landing surface and human biomechanics require real jumpers to adjust their technique accordingly.

Some key points around projectile motion include:

- Horizontal velocity component: Represents the speed along the runway, crucial for distance.
- Vertical velocity component: Gives lift to clear the pit but generally remains smaller than the horizontal component.
- Time of flight: Controlled by vertical motion; falling from a lowered landing surface means longer air time.
- Takeoff angle: A compromise balancing upward lift and forward speed.

The athlete's body acts not just as a passive projectile but as an active system managing rotation and alignment mid-air using limb movements to optimize form and maximize jump length.
Maximizing distance with optimal landing techniques in projectile motion

Many might think the jump ends at takeoff, but the landing phase can add crucial centimeters. Jumpers prepare by positioning their heels forward along the expected trajectory to ensure first contact with the ground is as far ahead as possible, minimizing backward fall.

As the heels touch down, hamstrings contract and hips rise to convert forward momentum into ground contact force. Athletes often lean forward with arms and body to carry their center of mass past their feet. This ensures maximum horizontal distance without compromising balance.

For this reason, long jumpers train landing techniques as rigorously as their run-up and takeoff.
Using technology to analyze and enhance projectile motion in the long jump

Today’s athletic training leverages high-speed motion capture, biomechanical simulations, and data analytics to refine every aspect of jumping. These technologies reveal subtle body positioning and muscle activations that influence flight trajectory and landing efficiency.

Simulation software allows athletes and coaches to adjust variables such as takeoff speed, angle, and limb movement patterns to identify ideal combinations tailored to individual physiques. Real-world data combined with physics models facilitates personalized coaching. This can incrementally improve jump distances—every millimeter counts on a competitive stage.

The long jump exemplifies a beautiful synergy between human athleticism and physics principles, especially projectile motion. Through controlled acceleration, optimized takeoff angles, and biomechanics-informed mid-air and landing techniques, elite athletes push the boundaries of what is possible.

Understanding the science empowers coaches and athletes to hone performance and maximize results. As viewers at the Olympics witness incredible jumps, they can appreciate not just the athletes’ strength and skill, but the physics mastery embodied in each leap.

Their physical properties are unique and their formations and movements change. They impact the environment, ships, icebreakers, and other structures.

"A sandwich structure made with carbon fiber-reinforced epoxy prepreg and PVC core was investigated. Low-velocity ice impact was modelled using the Ansys Workbench 2023 R2 and LS-DYNA R11 explicit solver."

MDPI – Web - [Numerical Investigation of Low-Velocity Ice Impact on a Composite Ship Hull Using an FEM/SPH Formulation]

A. Pavlovic, G. Minak

Dept. of Industrial Engineering,
Univ. of Bologna, Italy

EXCERPTS

Figure 5. Details about the discretization method: (a) ice in particles (SPH) and sandwich in elements (FEM), (b) application of boundary and load conditions

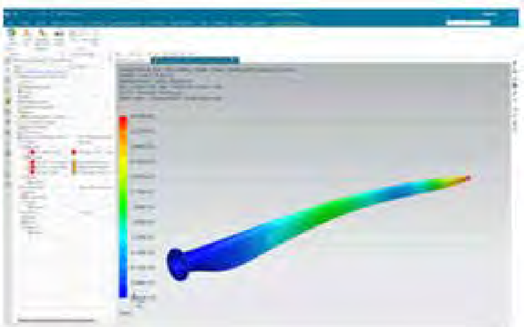
Abstract - In cold climate regions, ships navigate through diverse ice conditions, making the varied interaction scenarios between hulls and ice critically important. It is crucial to consider the safety and integrity of the hull during an ice–hull interaction, especially in the presence of lightweight structures. Proper design and material selection can help improve the structure's ability to withstand ice forces. Within the scope, understanding the behavior of ice and its interaction with the structure can inform the development of appropriate measures to minimize possible damage or failure. The current study focuses on the interactions occurring during the impact loading phases, which are characteristic of thin first-year ice. A sandwich structure made with carbon fiber-reinforced epoxy prepreg and PVC core was investigated. Low-velocity ice impact was modelled using the Ansys Workbench 2023 R2 and LS-DYNA R11 explicit solver. As the material model, the *MAT055 was chosen based on the literature, while ice was represented with its equation of state. The Tsai Wu criterion was adopted to identify tensile and compressive failure in the matrix and fibers. This simulation allowed us to evaluate how the composite material responds to ice impacts, considering factors such as the speed of the impact, the shape and thickness of the ice, and the properties of the composite material itself.

2.1. Ice Model Assessment - ...The ice block has been discretized with the SPH method, as shown in Figure 5a. The diameter of each particle has been chosen as 5 mm to reduce the computational time. The sandwich structure has been discretized by a shell quadrilateral element, Figure 5a. The size was 10 mm to avoid penetration between the particles and structure. **In both cases, explicit physical properties were selected during the Ansys LS-DYNA simulation**...The boundary conditions were set as fixed support on the four faces of the sandwich structure, indicated in blue in Figure 5b. Gravity and velocity of 5 m/s and 10 m/s were applied to the ice block in the Y direction. An impact velocity between 1–10 m/s is usually treated as low-velocity impact (LVI), while the ship–ice interaction occurs at a lower speed, for example 5 knots (2.6 m/s), which falls into the category of LVI [53,54,55,56].
The frictionless contact between the ice and the sandwich structure was defined as *CONTACT_AUTOMATIC_NODES_TO_SURFACE. The explicit Ansys LS-DYNA numerical simulation was performed in 8 ms.

Material Model - ...In LS-DYNA, the material "crushable foam" (*MAT63) was applied in the ice and PVC in compression simulations. …..

Article quote, “Travelling by plane is nowadays very safe, thanks to frequent maintenance and inspections. The current level of reliability was reached after decades of analyzing past catastrophic events and responding with several aircraft improvements and with the introduction of stricter maintenance rules

Short Excerpt



Siemens – Web - Accurate virtual sensing for complex aviation structures

Roberta Cumbo, Daniel De Gregoriis, Abhishek Kumar and Frank Naets

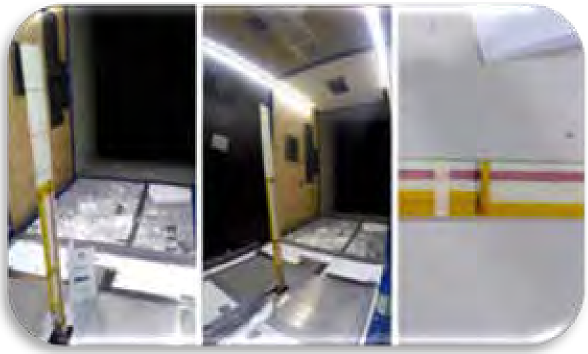
1. The challenge of maintaining aircraft safety - ... Past failures have often been the result of a lack of knowledge on operational stresses and loads, and insufficient maintenance processes to detect complex failures and defects.

Overall, aircraft manufacturers face the challenge to design and operate the highly complex aircraft system/structure, comprising many parts and components, materials and connectors, flight systems, electronics and controls systems, etc. Aircrafts must last for decades and endure challenging and variable operational conditions. Moreover, a single local failure can have severe system-level consequences, up to an aircraft crash. Physical maintenance schemes are therefore scheduled, aiming at understanding the state or condition of the aircraft, its subsystems and components, and making all necessary repairs at the right time, but leading to significant aircraft downtime.

Wouldn’t it be great for aircraft operators to perform much more measurements on the aircraft, even in operational conditions? Such practice could yield real-time insight into the loads, the aircraft parameters … that can be analyzed to identify initiating failures early.

Unfortunately, this is not yet feasible today. One aspect is that each additional sensor will contribute to the overall cost as well as introduce additional weight. This also results in additional performance requirements, cost and weight of the system that processes these measurements. Moreover, some components and subsystems are not easily accessible for instrumentation. As a result of these challenges, the number of sensors that can be installed in an operational aircraft is limited. Today, it is therefore not yet possible to detect the initiation of failures, monitor degradation evolution, or directly measure the performance (e.g. static and dynamic response) at every possible location.

The materials used in modern aircraft add yet another challenge to its design and operation. For example, composite materials have the benefit of delivering the same level of strength as metals, while weighing significantly less, which contributes to the aircraft fuel efficiency and lowers the operational cost. Although composites require less maintenance than traditional materials, they are typically more expensive to fix when they do need a repair. Composite materials have complex failure modes, which makes it challenging to do the correct measurements over the full aircraft to monitor their condition. To address this challenge for composite laminates, Material Technologies Labs in Leonardo SpA supports scientific research into on-line monitoring of delamination growth in laminates. The strength and stiffness of composite structures reduce due to delamination, which can lead to loss of structural integrity and potentially failure of the structure. The ability to beter estimate and monitor local structural and materials properties is therefore of great interest.



Left - Wind tunnel testing of a scaled composite helicopter blade. As to monitor complex phenomena such as delamination, the blade has been instrumented with embedded Fiber Bragg Grating-based strain sensors.

2. Ph.D. research results: Accurate parameter and load estimation for complex aerostructures - Considering the above, aircraft manufacturers are highly interested in capturing the aircraft state and condition more effectively, considering the benefits this can bring for aircraft operation and safety. This motivates new research for more accurate and robust estimation methods, as well as research for on-line monitoring of complex systems, including optimal sensor placement and Virtual Sensing (i.e. get more insights out of test data by leveraging accurate numerical models). Along these lines, Roberta Cumbo pursued her Ph. D. research project1, achieving multiple contributions to the field of accurate estimation of parameters and loads for complex aerostructures.

An important base technology for the research has been the Kalman filter, a widely established mathematical algorithm that combines noisy measurements series over time with a model of the system to estimate the state of a dynamic system. Roberta's Ph. D. research adopted the Augmented Kalman Filter (AKF) formulation to solve joint input/parameter/state estimation1. A Virtual Sensing strategy was pursued to estimate unmeasured quantities by readily combining experimental and numerical data of the analyzed system.

The Ph. D. research led to new methodologies to achieve accurate and robust estimation techniques, and produced further industry-driven research outcome to ensure applicability in real-life aircraft structures:

- Increase the robustness of Kalman filtering methods. Research results reported include:
- Model calibration, reduction and virtual sensing, to allow using more accurate yet efficient models within the Kalman estimation workflow2
- Advanced Optimal Sensor Placement techniques for robust sensor selection to ensure system observability. This enables optimal sensor placement for Kalman-based input estimation3. This key contribution is further explained in Section 3.
- Extend and enable the usage of Kalman filtering for unexplored application domains: This research delivered further technology innovations to address the aircraft estimation challenge.
- A rotating helicopter blade has been investigated and addressed with the Kalman-based state and input estimation framework4
- Research into on-line monitoring of composite delamination growth in the laminates has been worked out5 in close collaboration with Leonardo SpA. As mentioned above, the use of composites materials represents a key challenge – with interest to optimally design and define them in the aircraft that is built, and to be able to monitor the material characteristics over time, during operation, and learn early about possible failure initiation and degradation over time.

Continue on the website for the complete article including:
3. Optimal sensor placement: Motivation and achievements
4. Conclusion and outlook

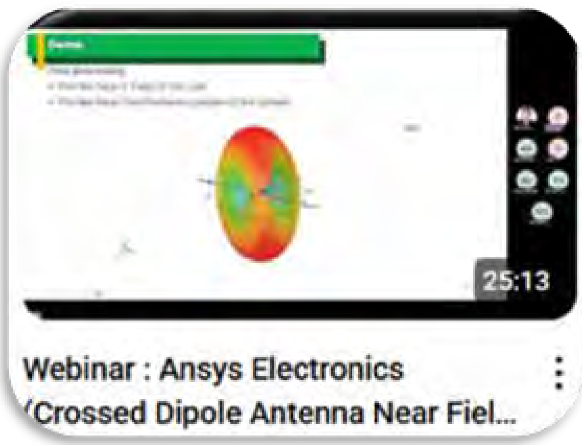
DFE-tech "Our goal is to equip our customers with the necessary knowledge and management solutions to today's challenges."

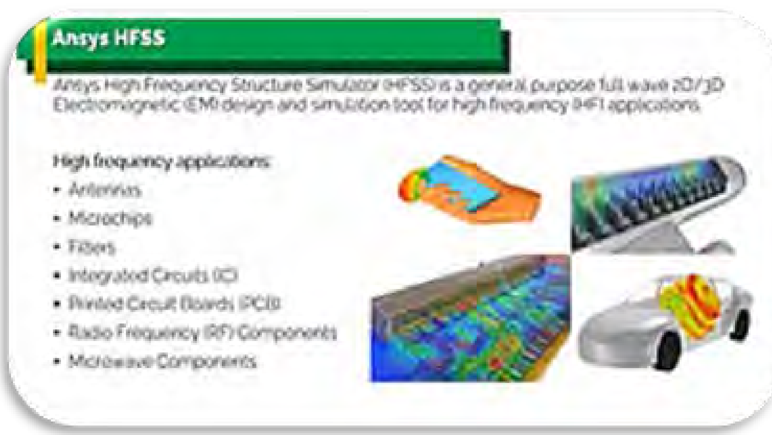
Among the videos we offered this year on YouTube Channel for your convenience to have information, learn, gain knowledge - contact us!

A few of the webinar videos on our channel

Webinar : Ansys Electronics (Crossed Dipole Antenna Near Field Simulation using Ansys HFSS)
by Muhmmad Farhan Rosman

This webinar will cover the design and simulation of a Crossed Dipole Antenna using Ansys HFSS. You will learn how to use HFSS modeling tools to design the antenna, simulate Near Field Radiation with pre-processing tools, and extract and analyze Near Field Radiation Plots with post-processing tools. This session is ideal for anyone looking to enhance their skills in antenna design and electromagnetic simulations.





Article, "Increasing the data rate of pressure pulses in hydraulic-mechanical systems such as valve units for drilling fluid in steerable drilling tool... **With system simulation in Ansys Twinbuilder, the pulse generation in steerable drilling tools can be optimized.**"

Images: © Scientific Drilling

Web – CADFEM - **Scientific Drilling - System Simulation for the Optimization of Mud Pulse Telemetry**

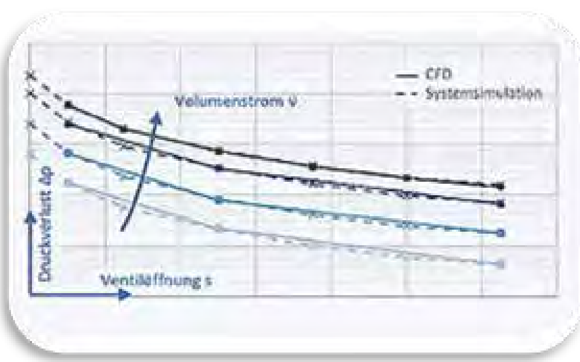
System simulation for higher data rate in MP telemetry systems

Sector: Machinery and plant engineering
Specialist field: Multiphysics

With system simulation in Ansys Twinbuilder, the pulse generation in steerable drilling tools can be optimized. For this purpose, the coupled behavior of mechanical and hydraulic components of the drilling fluid is analyzed under different operating conditions.

Task - When developing crude oil and natural gas deposits, controlling the course of drilling plays a decisive role in its subsequent productivity (see also CADFEM Journal 2/2019, "Systematically Drilled"). For this purpose, Scientific Drilling is developing steerable drilling tools at the Celle site, which can communicate with systems on the ground surface by using pressure pulses in the drilling fluid during the drilling process (mud pulse or MP telemetry). A hydraulic-mechanical valve unit serves as the core of this technology.

The data rate of current MP telemetry systems is limited & too low for the growing amounts of data that have to be transmitted over greater distances in increasingly shorter time intervals. In order to increase the data rate, the various influences on the pressure pulses - such as volume flows and valve properties - are to be examined in a system simulation.

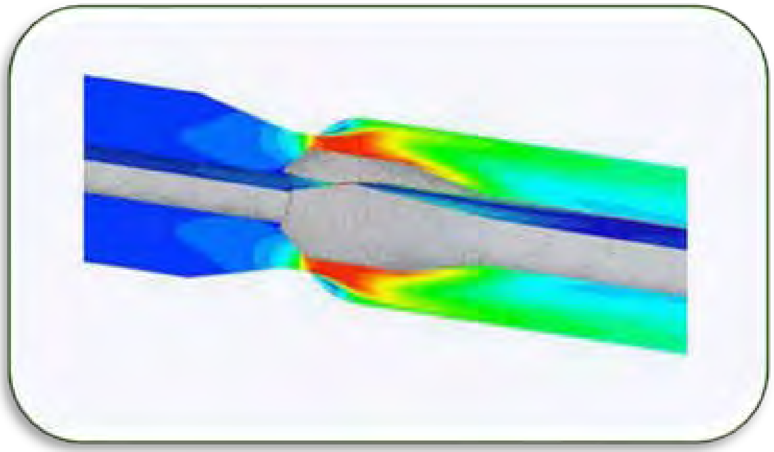


Solution - As part of the system simulation with Ansys Twinbuilder, the pulse generation, i.e., the coupled behavior of the mechanical and hydraulic components, was examined. For this purpose, the valves for pressure pulse generation were characterized using several CFD analyses with Ansys Fluent. This way, the pressure losses could be determined depending on the valve position for a selected volume flow and made available for the system simulation.

Above: Valve pressure losses with varying valve opening for different volume flows. The losses of the flow simulation (CFD) flow simulation (CFD) with the system simulation.

However, examination of the pressure pulses requires an analysis of the system behavior with different volume flows depending on the pumping capacity and drilling depth. In order to reduce the required number of CFD analyses, the system model was adapted with elements from the Modelica Standard Library, which enabled a volume-flow-independent characterization of valves.

Thus, the numerical simulation results can be complemented by the analytical approach of the Modelica components in order to represent a wide range of operating conditions at low numerical effort.

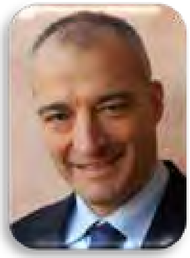


Left: Schematic representation of positive pressure pulses from the system simulation. In addition, the flow velocity in the valve gap with the valve partially closed from the CFD analysis.

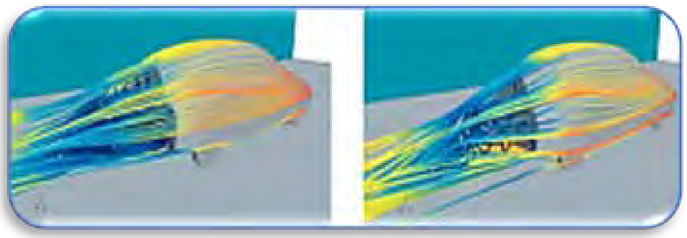
Customer Benefit

Using the system simulation, various dynamic processes for generating the pressure pulse could be examined. The previous understanding of the system was expanded, and the simulation results were also used to identify potential improvement options.

- By using the Modelica components, it was possible to reduce the number of CFD analyses required.
- The resources freed up in this way can be used directly for the examination and further development of the design of essential components - for example, the valves.
- Existing potential for improvement in terms of system behavior can be identified and compared.



In this paper, an RBF mesh morphing-based method suitable for tackling generic CAE industrial applications is presented. A strong coupling between the mesh morphing engine and the solver environment was already implemented for Ansys (fluids and structures). The present work aims to highlight the challenges posed by the integration of advanced mesh morphing in CAE solvers and to propose, as an example, a method of general integration



MDPI – web - Integration within Fluid Dynamic Solvers of an Advanced Geometric Parameterization Based on Mesh Morphing (Sept. 2022)

U. Cella, D. Patrizi, S. Porziani, T. Virdung and M. Evangelos Biancolini

Fig 7 Comparison between baseline (a) and selected optimum (b) solution for the ASMO model.

- Dept of Enterprise Engineering “Mario Lucertini”, Univ of Rome “Tor Vergata”, Italy
- Volvo Car Corporation, Karossvägen 2, 418 78 Gothenburg, Sweden

Abstract - Numerical optimization procedures are one of the most powerful approaches with which to support design processes. Their implementation, nevertheless, involves several conceptual and practical complexities. One of the key points relates to the geometric parameterization technique to be adopted and its coupling with the numerical solver. This paper describes the setup of a procedure in which the shape parameterization, based on mesh morphing, is integrated into the analysis tool, accessing the grid nodes directly within the solver environment. Such a coupling offers several advantages in terms of robustness and computational time. Furthermore, the ability to morph the mesh “on the fly” during the computation, without heavy Input/Output operations, extends the solver’s capability to evaluate multidisciplinary phenomena. The procedure was preliminary tested on a simple typical shape optimization problem and then applied to a complex setup of an industrial case: the identification of the shape of a Volvo side-view mirror that minimizes the accumulation of water on the lens of a camera mounted beneath.

1. Introduction - A design problem consists of a series of activities aimed at modifying the information that characterizes the object to be designed [1]. Such information is related to entities that quantify the dimension and define the shape. The designer changes the state of the entity until the result obtained is considered satisfactory. The adoption of computers as design tools enables the possibility of creating more sophisticated relationships with such information. Models that adopt algorithms to define the entities that qualify and quantify the object to be designed are called parametric. The parameters are non-geometric features defined by dimensional, geometric, or algebraic constraints [2]. They are used to shape the objects according to rules that determine the relationship between design intent and design response [3]. The result is a parent–child interdependency between the features, allowing the rapid alteration of existing models by simply editing the values of some parameters [4].

Parameterization is the key aspect of all procedures in which a shape variation is involved. In automatic workflows, as in numerical optimization environments, it plays a crucial role, but also direct design processes significantly take advantage of the availability of tools able to generate new geometries with moderate user manual intervention rapidly. In the context of mechanical design, the implementation of feature-based parametric modeling paradigms within CAD (Computer-Aided Design) systems provides a significant impulse to the development of more efficient design approaches. When coupling parametric geometric models with CAE (Computer-Aided Engineering) analysis tools involving discretized domains, a procedure that updates the numerical configuration following the shape variation is required. Such an approach imposes a remeshing technique [5] and the development of a set of scripts and batch procedures that couple/guide the code execution in sequence in an automatic workflow [6]. It allows very large flexibility in implementing complex combinations of constraints and variables, exploiting the great potentialities modern CAD systems provide. Advanced implementation might also incorporate a topology control of the geometry by involving the generation of new CAD features to the model allowing the use of the newly added parameters [7]. Nevertheless, when dealing with aerodynamic optimization, or in general with numerical problems involving large computational domains, the remeshing action of new candidates might be very time-consuming. Remeshing also introduces numerical noise when comparing different solutions due to the inconsistency of the regenerated mesh with the old one. To mitigate these drawbacks, a strategy that can be implemented is to adopt structured meshes and/or overlapping grids [8], but such methods are usually limited to simple geometries. Very highly skilled users in both parametric solid modeling and in CAE analyses are always required [9].

From an industrial point of view, fast and easier shape optimization methods that require fewer efforts in setup activities are strongly desirable. An approach acting in this direction is to operate the parameterization directly on the numerical domain using mesh morphing techniques [10]. This strategy allows bypassing both the CAD model coupling and the mesh regeneration process with significant advantages in terms of solution consistency, workflow robustness, and time to setup. Several numerical techniques to solve the mesh morphing problem are possible. Some of the most popular in the past were mainly based on the Free-Form Deformation (FFD) [11] and the elastic models [12] proposed in both research and commercial codes. Today, Radial Basis Functions (RBF) have become a well-established tool to interpolate scattered data [13] and are considered one of the most efficient mathematical frameworks to face the problem of mesh morphing. RBFs, in fact, provide a better precision allowing exact control of nodes movement and exact preservation of surfaces [14]. The power of RBF mesh morphing is demonstrated in [15], with an aerospace application concerning the optimization of a wing.

The first commercial mesh morphing tool based on radial basis functions was RBF Morph (www.rbf-morph.com, accessed on 15 August 2022) [16]. A description of the software can be found in [17]. The code proved its efficiency in several fields of engineering. Examples of aerospace applications can be found in [18], where it is coupled to an adjoint solver for an external aerodynamic optimization problem, and in [19], where it is applied to model the ice accretion on an aerofoil. In [20], RBFs are used to generate the surface of a measured wind tunnel model. Several problems were successfully faced with RBF mesh morphing in other fields of engineering such as nautical [21], biomedical [22], automotive [23], train [24], and oil and gas [25]. Examples of applications to structural problems are reported in [26,27].

In this paper, an RBF mesh morphing-based method suitable for tackling generic CAE industrial applications is presented. A strong coupling between the mesh morphing engine and the solver environment was already implemented for Ansys (fluids and structures). The present work aims to highlight the challenges posed by the integration of advanced mesh morphing in CAE solvers and to propose, as an example, a method of general integration. The coupling is here demonstrated using the

Simcenter STAR-CCM+ (www.plm.automation.siemens.com, accessed on 15 August 2022) CFD code and the RBF Morph toolkit under development. The integration is made by developing User-Defined Functions (UDF) that provide direct access to the coordinates of the mesh, allowing for control of the shape according to the RBF parameterization setup. The innovation consists of making the mesh morphing feature from the solver environment available and, during the solving process, extending the analysis capability with a more efficient numerical configuration. An example of the great advantage of such a coupling is highlighted in [28], where an FSI (Fluid Structure Interaction) problem is faced by both a two-way and a modal approach. In the latter case, an intrinsically aeroelastic CFD configuration is created.

The implemented workflow was preliminarily tested on a simplified problem of external car shape aerodynamic optimization and then applied to a more complex industrial test case concerning the minimization of the water accumulation on the lens of a camera mounted below the side-view mirror of a Volvo car.

Picture Excerpts:

Figure 3. ASMO geometry.

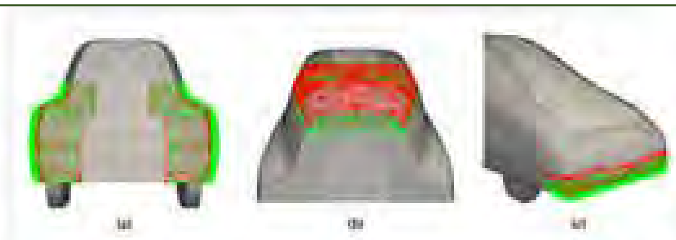
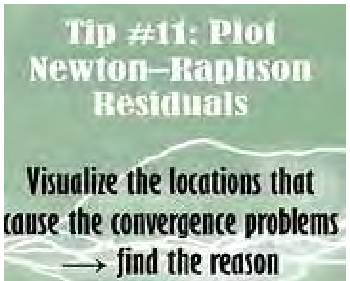


Figure 4. Boat tail (**a**), roof drop (**b**) and front spoiler (**c**) shape modifiers of the ASMO geometry.

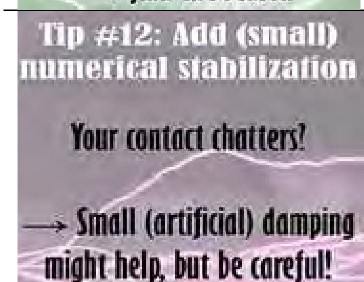
Figure 8. DrivAer car model (**a**) and detail of *Volvo* side mirror (**b**).

Struggling with convergence in nonlinear FEA? You're not alone! Since 2008, I've been passionate about providing training for Ansys users on nonlinear simulation with Ansys Mechanical. Over the years, I've seen hundreds of models struggle with convergence – and supported just as many engineers in overcoming those challenges. stay ahead of nonlinear convergence issues.



Tip #11: Plot Newton–Raphson Residuals

Instead of guessing, visualize where the solver struggles. Enable Solution Information → Newton–Raphson Residuals. Hotspots in the residual plot often reveal poor mesh quality, problematic contacts, or unconstrained regions. Fix them locally, and convergence often improves dramatically.

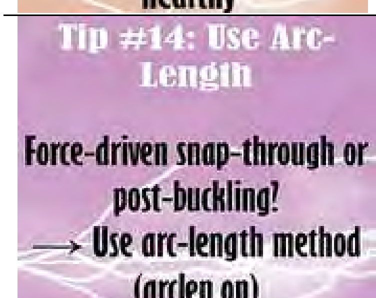


Tip #12: Add (small) numerical stabilization

If your contacts chatter or the residual oscillates, a touch of artificial damping can stabilize the solution. The key is moderation — just enough to guide the solver through the rough phase, without distorting the physics.

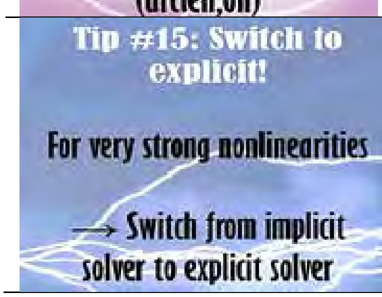
Tip #13: Nonlinear adaptive meshing

Distorted elements are a hidden convergence killer. Good mesh quality is the foundation, but in highly nonlinear deformation, enabling nonlinear adaptive meshing helps keep elements healthy and improves solver robustness.



Tip #14: Use Arc-Length method

When snap-through or post-buckling behavior appears, load-driven simulations often fail. The arc-length method follows the equilibrium path even if the stiffness gets negative! Yes, negative!

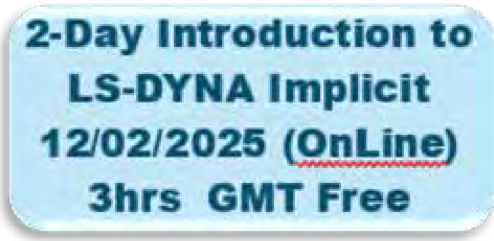


Tip #15: Switch to explicit!

Some problems are just too nonlinear for an implicit solver. For highly dynamic contacts, extreme deformations, or severe nonlinearities, switching to an explicit solver is often the most pragmatic way to reach a solution.

Don't miss our 2 Day (Online) Course.

Introduction to LS-DYNA Implicit - December 2025



Web – OASYS – **2 Day Introduction to LS-DYNA Implicit December 2025 (Online)**

An online introduction to LS-DYNA implicit: required input cards and most common analysis types.

This course is for engineers who are seeking to gain knowledge in LS-DYNA implicit analysis. Previous experience in LS-DYNA explicit is recommended.

This training course is provided free of charge to Arup Oasys/LS-DYNA clients on a first come-first-serve basis.

Please do not hesitate to contact us if you require this training and you are not an Arup Oasys/LS-DYNA client.

The online format will run as a series of 3-hour sessions over two consecutive days.
The online course will be run using Microsoft Teams.

- Session 1: Tuesday 2nd December – 09:30-12:30 GMT
- Session 2: Wednesday 3rd December- 09:30-12:30 GMT

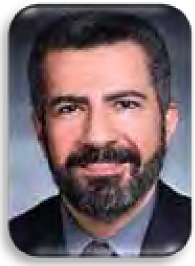
Course Outline:

The course is an introduction to the use of implicit analysis in LS-DYNA. The main focus is on the different types of linear and non-linear static analysis. The required input cards for each one of them are discussed.

Course Content:

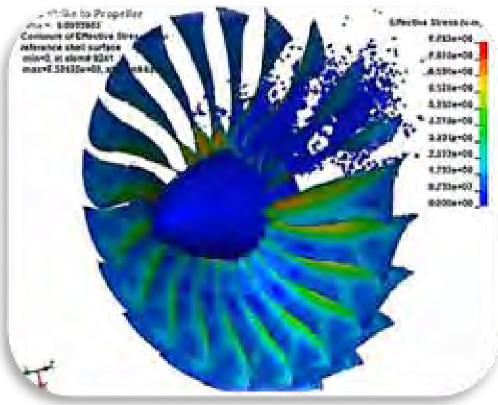
- Implicit vs. explicit
- Memory
- Time / Timesteps
- Element formulation
- Material models
- Contacts
- Control cards
- Dynamic Relaxation
- Control / Database Cards
- Linear Static Analysis
- Non-Linear Static Analysis
- Intermittent Eig. Analysis
- Freq. Response Analysis
- Buckling Analysis
- Other

Relevant Products - LS-DYNA



"…we use LS-DYNA's nonlinear dynamic solvers to simulate bird strike events under realistic flight conditions"

There's nothing theoretical about a four-pound bird smashing into your multi-million dollar propulsion system at 200 knots. Bird strikes aren't just statistical risks. They're violent, high-energy impacts that happen thousands of times a year.



Web – Predictive Engineering -[The Real Cost of Bird Strikes and the Value of Simulation]
Maysam Kiani

Left – YouTube Video

For airlines, each event is more than just costly downtime. It is a direct safety threat that can ground an aircraft or, in the worst case, force an emergency landing. This is why the FAA treats bird ingestion tolerance as a critical part of engine certification.

When a strike happens, it is not just your blades and spinners that take the hit, it is your certification program, your schedule, and ultimately passenger safety that are on the line. At Predictive Engineering, we don't believe in waiting for the feathers to fly. With more than two decades of experience in impact modeling, our simulation engineers help companies predict, analyze, and mitigate bird strike events long before they reach the test stand. More importantly, we ensure their designs are prepared to meet FAA bird strike requirements and sail through certification.

The Real-World Damage from a Featherweight - According to FAA Advisory Circular 150/5200-32C, more than 276,000 wildlife strikes were reported to the National Wildlife Strike Database between 1990 and 2022. During that period, 34,261 of those incidents had adverse effects, including aircraft damage or operational impact. In 2022 alone, the estimated financial impact of wildlife strikes to U.S. civil aviation was 385 million dollars, combining both direct and indirect costs such as repair downtime, flight delays, and lost revenue [FAA AC 150/5200-32C, 5.1].

FAA Requirements: No Room for Guesswork - The FAA regulation 14 CFR 33.76 outlines specific certification requirements for bird ingestion. Whether it's a single bird, a multi-bird flock event, or a large bird ingestion scenario, manufacturers are required to prove that their propulsion systems can tolerate such impacts without causing catastrophic failure.

These rules are not hypothetical. They're backed by FAA Advisory Circular AC 33.76-1B, and compliance is mandatory for certification.

Why Physical Testing is Painful and Often Pointless Early On - Bird ingestion tests are not just expensive, they are destructive by design and often wasteful if attempted too early in the development process. The list below summarizes the items that can drive costs to well over $1 million for physical testing:

- Cost per physical test: Industry estimates place the cost of a full-scale bird ingestion test between $250,000 and $1,000,000. The FAA does not publish costs in its regulations or advisory circulars, but this range reflects reported figures from engine OEMs and U.S. test facilities such as NASA Glenn and Arnold Engineering Development Complex. Expenses include

- test article fabrication, bird launcher setup, high-speed instrumentation, facility time, and teardown.
- Test setup: Requires gelatin-based bird surrogates or cadavers, calibrated refrigeration, and precision launch velocities.
- Infrastructure: Specialized high-speed cannons, reinforced containment chambers, and sensitive data acquisition systems.
- Outcome: More often than not, the result is a destroyed engine, a mountain of scrap hardware, and only one usable dataset before the next redesign.

When a test fails, there is no do-over. It means new hardware, new fabrication, new scheduling, and another six-figure invoice to get back in line.

The situation is comparable to crash testing vehicles. Automakers destroy full prototypes in controlled crashes, but they do not crash every variant. Instead, they run dozens of validated simulations to identify the most critical impact scenario, then commit to a handful of full-scale crashes. Propulsion system bird strike testing is no different. It is not practical to fire every possible bird size, speed, and angle. The FAA recognizes this reality. Advisory Circular 33.76-1B specifies a standard large bird ingestion speed of 200 knots true airspeed (about 103 m/s) as the baseline test condition, while allowing alternate speeds if an applicant can demonstrate they are more conservative or more representative for the engine design [FAA AC 33.76-1B, 8.4].

Bird strike simulation can be done at a small fraction of the cost and enhance physical testing when the time comes. By modeling bird size, strike angle, and blade rotation phase, engineers can determine which conditions are most critical. Only those worst-case scenarios need to be tested physically. The result is fewer prototypes sacrificed, a higher chance of passing the certification test, and millions of dollars saved in development.

What Simulation Engineers Bring to the Table - At Predictive Engineering, we do not waste good hardware just to learn something obvious. Instead, we use LS-DYNA's nonlinear dynamic solvers to simulate bird strike events under realistic flight conditions. Our bird surrogate models, built with either SPH or Eulerian formulations, impact high-fidelity CAD geometries of blades, hubs, and housings. The result is a virtual test chamber where the carnage plays out on screen instead of on a million-dollar engine.

This approach lets us push designs to their limits long before the first physical test. We can try scenarios no test facility could ever set up. We can vary bird sizes, angles of impact, and blade rotation phases. We can run dozens of strikes in days rather than months. Most importantly, we can isolate the exact condition that is most likely to break the part. Once that critical impact is identified, then and only then does it make sense to move to the test stand.

Our simulation engineers make it possible to:

- Visualize failure modes before hardware exists
- Identify localized high-stress concentrations and hot spots
- Evaluate composite delamination, ductile tearing, and crack propagation with rate-dependent material models
- Pinpoint weak points that would never survive a physical strike

And the best part? We do it all before a single dollar is spent on physical hardware. Instead of gambling with destructive tests, our clients go into certification knowing they are lined up for success on the first shot.

What We Offer at Predictive Engineering - With over 25 years in the field and hundreds of impact studies completed, Predictive Engineering has the experience and the tools to turn a certification headache into a controlled process. Our consulting team provides:

- High-fidelity bird strike simulations that replicate FAA ingestion test conditions for single bird, flocking bird, and large bird scenarios.
- FAA interpretation support for 14 CFR 33.76 and AC 33.76-1B, ensuring compliance from the start rather than during a costly redesign.
- Advanced material modeling for strain-rate sensitive metals, orthotropic composites, structural foams, and layered systems.
- Validation and correlation workflows that link virtual simulations with real test results for added confidence.
- SPH, Eulerian, and hybrid Lagrangian methods to model bird surrogates with accuracy that matches FAA acceptance criteria.

Whether you need early design validation, certification guidance, or independent verification of existing results, our engineers bring technical expertise and industry perspective to support your program.

Let’s Talk Before the Cannon Fires

If you are preparing for FAA bird ingestion testing or just want to sanity-check your design, talk to us first. We will simulate it, you will learn something valuable, and your test article will have a much better chance of passing the first time. Every simulation we run reduces the chance of wasted prototypes and failed certification runs.

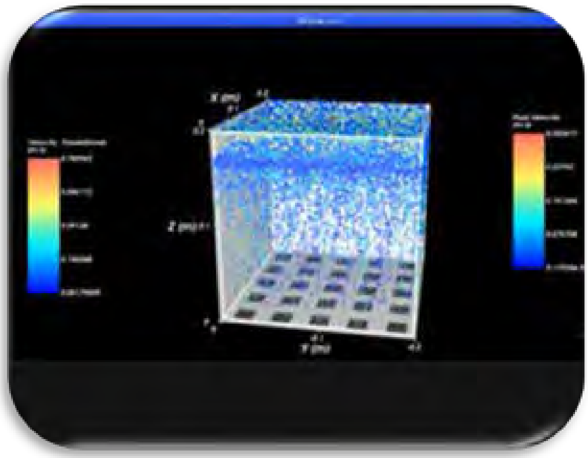
Contact Predictive Engineering today for an introductory meeting and a custom proposal.

Our experts regularly publish insights, resources and learning in our Resources area on the Ozen Engineering website.

Be sure to mark your calendar for 2026 – March 10, 2026.
Don't miss out on our OZENCON conference.

US - 03/10/2026 [OZENCON]

Our conference is FREE to attend.
Register today.
Location: THE COMPUTER HISTORY MUSEUM



YouTube – **Two-Way Coupling with Fluent and Rocky: Applications in Water Treatment** - This video demonstrates the coupled simulation of an aerated water treatment tank using ANSYS Fluent and Rocky DEM. Fluent models the fluid phase with aeration-driven mixing, while Rocky tracks thousands of discrete granules interacting with the flow. The 2-way coupling captures how rising air bubbles induce circulation and how suspended particles feed momentum back into the liquid, providing a realistic representation of fluid–particle dynamics in treatment processes.

Key highlights of the video include:

- Setup of the aerated tank case with multiphase flow in Fluent
- Definition of aeration sources and bubble-induced mixing patterns
- Particle dynamics modeled in Rocky using DEM, including collisions and suspension
- 2-way coupling between fluid flow and particle motion for accurate interaction modeling

The article:

Two-Way Coupling with Fluent and Rocky: Applications in Water Treatment
Tiago Lins

Excerpts: Discover how Fluent and Rocky coupling can be leveraged for efficient CFD + DEM simulations. Here, we modeled an aerated tank, simulating the dynamics of granules commonly used in water treatment processes.

Challenge - In water treatment processes, improving mixing efficiency and controlling particle dynamics are key for achieving high-performance. One promising approach is to combine Computational Fluid Dynamics (CFD) with Discrete Element Method (DEM) using tools like ANSYS

Fluent and Rocky DEM. This 2-way coupling allows engineers to capture the mutual interactions between fluid and solid phases in complex systems, such as aerated tanks.

In water treatment applications, mixing is often enhanced by aeration. Air bubbles rising from diffusers at the tank bottom induce turbulence and circulation, which in turn promote mass transfer and suspension of solid particles. When solid carriers or granules are introduced (e.g., in Moving Bed Biofilm Reactors or aerobic granular sludge systems), their movement strongly depends on the flow field. Conversely, the presence of particles alters the local flow through drag, momentum exchange, and turbulence.

Engineering Solution

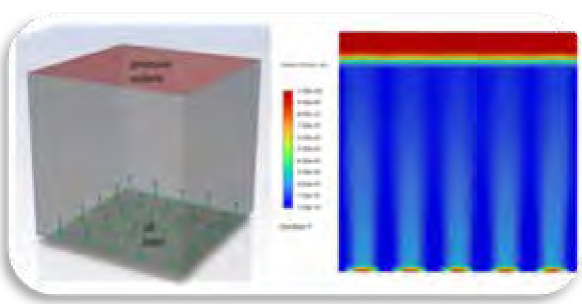
This interaction cannot be easily captured accurately with CFD alone or DEM alone.
That's where 2-way coupling comes in:

- **CFD (Fluent)** resolves the continuous fluid phase, accounting for turbulence, bubble-induced mixing, and aeration effects.
- **DEM (Rocky)** tracks each particle or granule individually, resolving collisions, particle shape effects, and settling tendencies.
- **Coupling** exchanges data at every timestep: the fluid exerts drag and lift on particles, while particles affect the momentum of the fluid field.

Case Study: Aerated Mixing Tank with Granules

Here, we modeled a square-shaped water treatment tank with aeration at the base. Air bubbles rise. Granules are suspended in the liquid. The modeling objectives are:

- **Mixing Efficiency** – ensuring particles remain uniformly distributed instead of settling.
- **Granule Dynamics** – predicting collision frequency, clustering, and residence time.
- **Flow–Particle Interaction** – quantifying how granule particles modify circulation and turbulence levels.



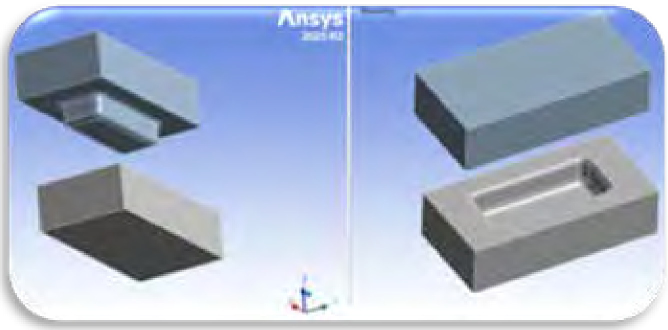
The first step is to set up a Fluent case with the desired geometry. In this simple design, we have air coming from the bottom of the domain as bubbles.

Please visit the website for the complete article

Tonight, on our local news channel in the town pointed towards its true north (FEA) we have original team reporting:
Mi (a resident news raccoon) & Ke (a resident news coyote)

Mi, “Quiz time – How do you overcome body-to-body misalignment?”

Ke, “No clue but Mike at Ozen gave me a lead on the answer. Mark Lytell has an interesting article about it. Let’s read it.”

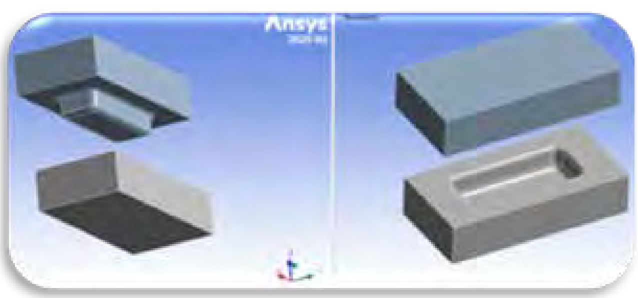


Web – Ozen - Ansys Workbench Motion: Implementing a SixMotion Joint to Overcome Body-to-Body Misalignment
by: Mark Lytell

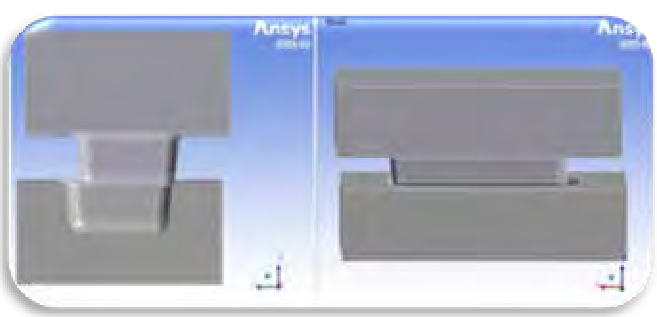
Excerpts – for the full article and graphics please visit the above link.

Introduction - A common application of multibody dynamics simulation is the insertion of one body into another. One such use case is the insertion of an electrical connector into a header in which the two bodies are initially misaligned. The initial misalignment requires motion in all 6 degrees of freedom (DOF) to achieve complete insertion. In this article, we will provide a method in Ansys Workbench Motion that utilizes a manually defined SixMotion joint to achieve the insertion of a tapered key into a base with tapered pocket.

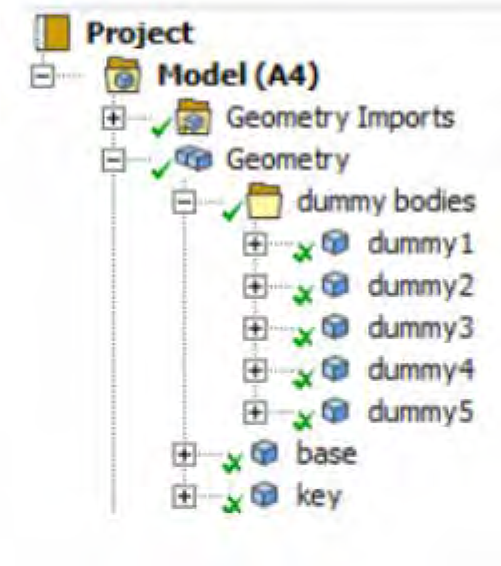
Example Model - To illustrate the procedure for implementing a SixMotion joint, we will use an example model in which we would like to insert a rigid male keyed part (top body) into a rigid base with female pocket (bottom body) that is fixed to ground.



The image shows the assembly in an exploded state. To begin, the key part is brought closer to the base and offset so that transverse, and potentially rotational, motion is required for insertion.



The image shows the y-direction (left image) and the x-direction (right image) skewed initial position of the key body.



Finally, five copies of the key body are created and placed in the same initial position of the key. These copies are dummy bodies each of which are used to impart one of the 6 DOF onto the key. The five dummy bodies are named dummy1, dummy2, ..., dummy5

6-DOF Motion Model

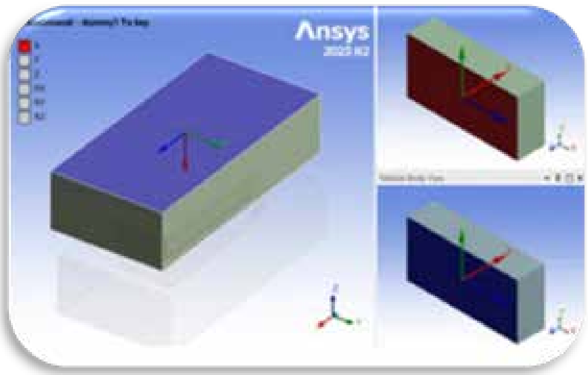
To implement the SixMotion joint, we need to establish a kinematic chain from key to base (to ground). The following model establishes that chain.

Kinematic Chain and Joint Connections -

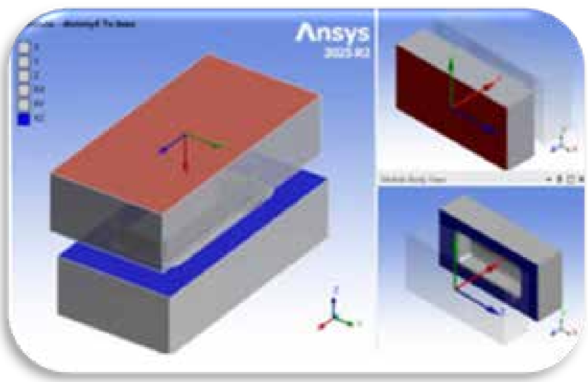
The kinematic chain that we would like to create is as follows:

1. **dummy1 -> key**: Translational Body-Body in Z-direction
    1. Vertical motion will be prescribed using Joint Load Properties and a Function Expression on this joint.
2. **dummy1 -> dummy2**: Translational Body-Body in Y-direction
3. **dummy2 -> dummy3**: Translational Body-Body in X-direction
4. **dummy3 -> dummy4**: Revolute Body-Body about Z-axis
5. **dummy4 -> dummy5**: Revolute Body-Body about Y-axis
6. **dummy5 -> base**: Revolute Body-Body about X-axis
7. **base -> ground**: Fixed

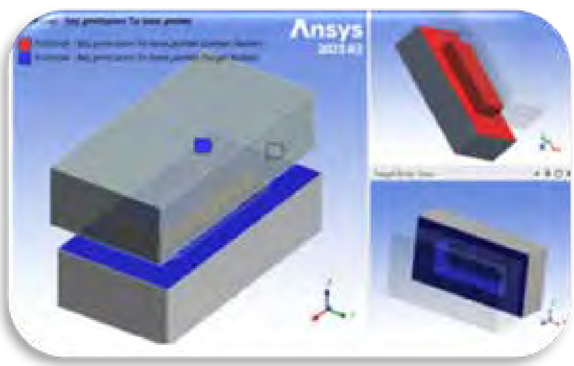
Note: It is required to align the X-axis of the reference coordinate system for each translational joint and the Z-axis for revolute joints to appropriate the global directions as described above.



For joints 1-5, we select the coplanar top face for the corresponding body as the Geometry Selection:



Similarly, the dummy->base joint is scoped as shown here



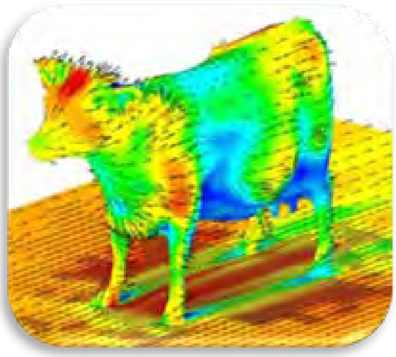
Contact and Contact Properties - Since the key and base pocket are misaligned, a frictional contact is defined so that the surfaces can move relative to each other

Continued on the website please find additional information and an animation of the results

- Design Variable
- Function Expressions
- Joint Load Properties
- Results - The resulting motion after running the model as described above is shown in this animation on the website

It's been 25 years since the original Aerodynamics of a Cow CFD image was generated using Simcenter FLOEFD, and 10 years since it was reimagined supersonically. In that time the air flow over a cow simulation has become the most viewed CFD result in history, a CFD Mona Lisa of sorts, spawning countless bovine memes, articles, and posts across social media.

Siemens Digital Industries Software



Web – Siemens - Aerodynamics of a Simcenter FLOEFD cow – A social media phenomenon - Robin Bornoff

Its appeal isn't grand or mysterious; it's simply that it makes people laugh. And in engineering, that's no small thing. Why? Because our field is dominated by precision, process, and the often-dry seriousness of 'getting it right.' Against that weight of rigour, humour is not just welcome but necessary – it breaks tension and restores perspective.

Psychologists would call it benign incongruity: the jolt of seeing two things that don't belong together suddenly collide. Advanced CFD airflow simulation applied to a Cow?? In all honesty it doesn't really need or deserve such attention. Sometimes that comes as parody, sometimes satire, sometimes sheer absurdity – and sometimes it's nothing more than the sight of a cow surrounded by CFD air flow vectors.

The Original Simcenter FLOEFD Cow

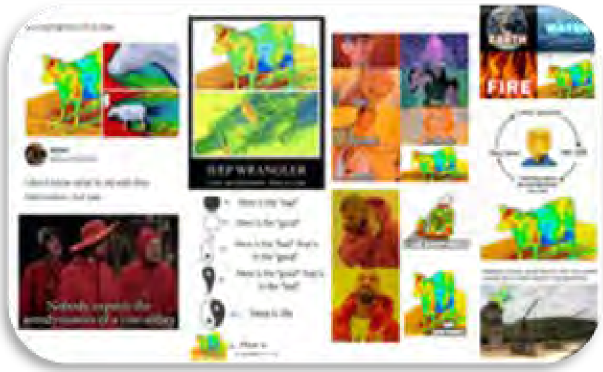
From the sublime to the redi-cow-less - So why is a cow in an airflow funny? Mainly because it's so gloriously pointless. We expect engineering visuals to feature cars, planes, or turbines – the serious machinery of industry.

Drop a farm animal into that context and the gravitas evaporates. The image becomes parody without words, satire without intent: advanced simulation applied to a subject that would never need it.

Humour often emerges when two things that don't normally belong together suddenly meet. Here it's your standard cow meeting the rarefied world of airflow simulation, a perfectly ludicrous pairing. The result is funny not because it threatens or shocks, but because it is so harmlessly absurd. And in a world heavy with pressure, complexity, and suffering, moments like this matter. They let us laugh, stay grounded, and remember the essential value of play.

Memes, but not as Dawkins envisioned - When Richard Dawkins introduced the word meme in his 1976 book The Selfish Gene, he wasn't thinking about cats, Ohio edits, or cows in a wind tunnel. He described memes as cultural replicators – units of information (like tunes, catchphrases, or fashion trends) that propagate through imitation, evolving as they spread and subject to Darwin's survival of the fittest.

Fast-forward to the 21st century, and the internet hijacked the word. 'Meme' became shorthand for a very specific visual & text joke format that thrives in the endless art of social media doom-scrolling. Yet if you squint, the modern meme isn't so far removed from Dawkins' intent. It's still about cultural transmission, replication, and survival of the fittest idea – only now the unit of replication is often an image with Impact font slapped on top. No more so true than for the aerodynamic cow.



I won't pretend, as a 54-year-old blogger, to track the rise and fall of internet memes with the same fluency as Gen Z. What I can say is that the Cow has followed the same pattern as many other online phenomena: it goes viral, drifts into obscurity, then resurfaces again – though stubbornly refusing to be forgotten.

Wearing our nonsense with pride - Of course, no meme is truly immortal until it finds its way onto a T-shirt. Sergio Antioquia, my co-author of our 'Can Cows Fly?' blog series:

(visit site for URL to Can Cows Fly? Simcenter FLOEFD Investigates. Part 1 – Only in the Mooovies)

.....

…and I benefitted from my brilliant children commissioning these 'Aerodynamics of a Cow' T-shirts – wearable proof that we (well maybe just I) may be old farts, but we still know how to have fun within the field we've worked in for decades. If you can't laugh at a CFD cow while running a CAE simulation, then when can you?

Sergio and Robin wearing their T-Shirts with Pride!

Udderly serious - In the end, the Aerodynamics of a Cow isn't just a meme. It's proof that industrial engineering has a soul, and that humour is as important to innovation as governing equations and conservation. If you think it's ridiculous, you're right. But that's exactly how humour works: it thrives on exaggeration, on twisting expectations, on making the serious look absurd and the absurd look serious. By doing so it punctures the dryness of process, restores perspective, and creates the mental freedom within which fresh innovations can emerge.

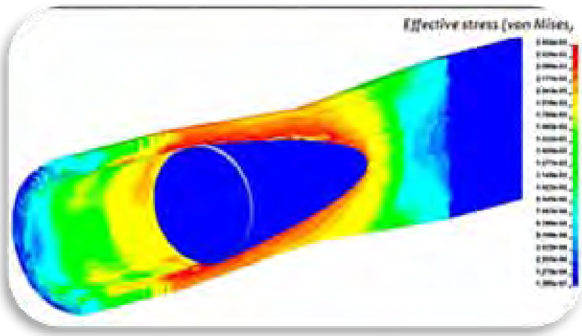
Memes like this aren't distractions; they're cultural pressure valves. They let us laugh at ourselves, share these moments of absurdity, and stay connected as a community. And if that means our most enduring legacy is an aerodynamic cow, then so be it – because ridicule, not reverence, is what keeps science, technology and engineering alive.

Video is on the website: Finally, and by way of celebration, here's our beloved virtual cow taking one last victory lap in a virtual wind tunnel – simulated with Simcenter and rendered in full Omniverse glory…
Siemens 4 Wind tunnel (https://skfb.ly/6YxR7) by SDC PERFORMANCE is licensed under Creative Commons Attribution (http://creativecommons.org/licenses/by/4.0/)

I had fun with the use of a magnifying glass as an asset in the 3D Omniverse USD scene. Placed between the Camera (your viewpoint) and the Cow, the magnification came for free as part of Omniverse's rendering technology.

Simcenter's visualisation capabilities have come a long way in the last 20 years and, as we adopt NIVIDIA technologies, they will certainly continue to evolve in the future! So thank you Cow and thank you Simcenter FLOEFD for bringing some udderly necessary silliness to serious CAE simulation. Moo.

Paper Quote, "**In this paper, three-dimensional numerical simulations of the piercing process are performed with an arbitrary Lagrangian–Eulerian (ALE) formulation in LS-DYNA software**. Details about the material model as well as the elements' formulations are elaborated here, and mesh sensitivity analysis was performed"



Web – MDPI - [A Useful Manufacturing Guide for Rotary Piercing Seamless Pipe by ALE Method]
by Ameen Topa, Burak Can Cerik & Do Kyun Kim

left: Stress concentration around the plug

- Ocean&Ship Tech.(OST) Res Grp (Dept Civil & Env Engin), Ins Transp Infra, (UTP), Malaysia
- Dept of Maritime Technology, Univ Malaysia Terengganu, Malaysia
- Dept of Naval Architecture and Ocean Engineering, Inha Univ, Korea
- Group of Marine, Offshore & Subsea Tech (MOST), Sch. Engineering, Newcastle Univ, UK
- Graduate Inst Ferrous Tech (GIFT), Pohang Univ of Science and Tech (POSTECH), Korea

Abstract - The development of numerical simulations is potentially useful in predicting the most suitable manufacturing processes and ultimately improving product quality. Seamless pipes are manufactured by a rotary piercing process in which round billets (workpiece) are fed between two rolls and pierced by a stationary plug. During this process, the material undergoes severe deformation which renders it impractical to be modelled and analysed with conventional finite element methods**. In this paper, three-dimensional numerical simulations of the piercing process are performed with an arbitrary Lagrangian–Eulerian (ALE) formulation in LS-DYNA software.** Details about the material model as well as the elements' formulations are elaborated here, and mesh sensitivity analysis was performed. The results of the numerical simulations are in good agreement with experimental data found in the literature and the validity of the analysis method is confirmed. The effects of varying workpiece velocity, process temperature, and wall thickness on the maximum stress levels of the product material/pipes are investigated by performing simulations of sixty scenarios. Three-dimensional surface plots are generated which can be utilized to predict the maximum stress value at any given combination of the three parameters.

Introduction - Metal pipes are categorized into welded pipes and seamless pipes. Welded pipes are commonly manufactured by bending and welding metal sheets, while seamless pipes are produced using the rotary piercing process. It is well recognized that seamless pipe provides more benefits than welded pipe, such as (1) increased pressure ratings; (2) uniformity of geometry, material properties, and matter; and (3) structural strength and fatigue capacities under load.

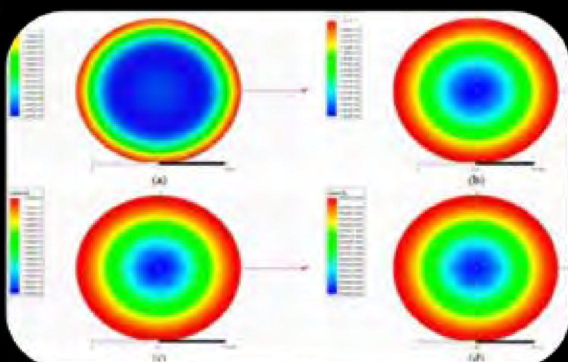
2.1. Material Models Selection - The stress–strain behaviour of Plasticine is like that of steel in hot conditions, thus, it is a good substitute for modelling the material behaviour during the piercing process. Apart from lead, which is another choice of material, Plasticine is more commonly used due to its low cost and the simplicity of analysing its material kinematics flow during formation [43,44].

Welcome to our two Pasture Movie Theaters

Information, Companies, Videos Not To Miss

FEANTM Town & Residents welcome you
And coffee and popcorn are free

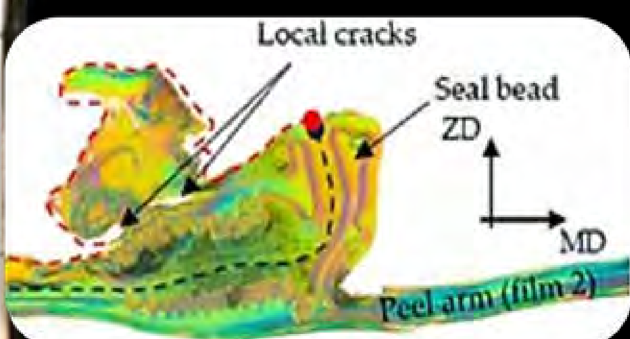
Yildiz Technical University



This study examines the induction heating equivalent circuit, discusses the general structure and design parameters of the induction coil, and performs FEM (finite element method) analyses using Ansys Maxwell.

MDPI - Web- [Induction Coil Design Considerations for High-Frequency Domestic Cooktops]

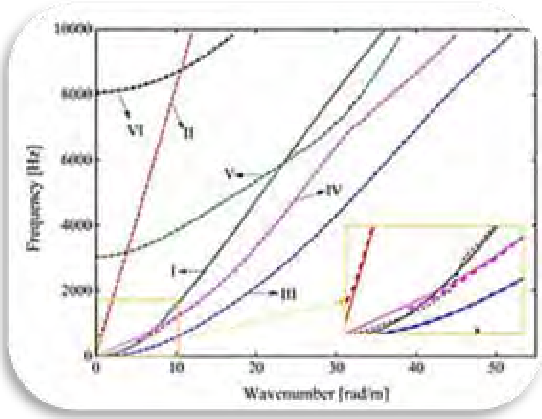
Fraunhofer Inst. for Process Engineering and Packaging IVV, Div



Section 3 outlines the modeling of the material with its individual layers, the fracture model, the geometry model, and the process model, as well as its implementation into the numerical simulation environment LS-DYNA.

MDPI – Web - [Numerical Investigations of the Seam Opening Behavior of Peelable Seal Seams as a Function of the Seal Seam Formation]

Figure below: Fig 3 - A 3D FE wheel-rail interaction model of the V-Track is developed in ANSYS software



Web - Taylor and Francis - [Comprehensive validation of three-dimensional finite element modelling of wheel-rail high-frequency interaction via the V-Track test rig]

P. Zhan, C. He, C. Shen, R. Dollevoet, & Z. Li
Section of Railway Engin., Delft Univ. Tech., Netherlands

EXCERPTS - Abstract - Wheel-rail high-frequency interaction is closely related to the formation of railway short-wave defects. Finite element (FE) method has been widely used to simulate wheel-rail dynamic systems, but its validity in modelling high-frequency interaction has not been fully demonstrated in three dimensions (3D).

This work aims at comprehensively validating the 3D FE modelling of wheel-rail high-frequency interaction using a downscale V-Track test rig. First, the FE model of the V-Track is developed that comprehensively includes the 3D track elasticity. The simulated track dynamic behaviours are validated against hammer tests, and the major vibration modes are analyzed employing modal analysis. Afterwards, the simulate wheel-rail dynamic responses are comprehensively compared with measurement results up to 10 kHz. Their characteristic frequencies are identified and correlated to the eigenmodes of the vehicle-track system. The results indicate that the proposed 3D FE model is capable of comprehensively and accurately simulating the 3D track dynamics and wheel-rail dynamic interaction of the V-Track up to 10 kHz. Rail vibrations dominate the wheel-rail dynamic contact within 10 kHz, while the wheel vibrations play an increasingly important role at higher frequencies and become decisive near the wheel eigenmode frequencies. The V-Track overall achieves dynamic similarity to the real vehicle-track system.

Introduction - In recent decades, the railway has become one of the most popular transport modes worldwide because of being safe, green and efficient. Railway trains keep evolving toward the higher speed and the heavier axle load to meet the increasing demand for a shorter travel time and a larger transport capacity. With increased train speeds and axle loads, various short-wave defects have occurred on the wheels and rails with higher probability, such as short pitch rail corrugation, squats, and wheel polygonisation [Citation1–5]. They excite large wheel-rail impact force, induce fierce vibration and noise, and further accelerate the deterioration of the vehicle-track system, which considerably increases the maintenance cost. The formation of the short-wave defects is closely related to the wheel-rail dynamic interaction [Citation6–10], especially in the high-frequency range (i.e. 1.5 kHz [Citation11]). To identify their formation mechanisms and develop the corresponding countermeasures, a good understanding of wheel-rail high-frequency interaction is needed.

Conclusions - This work comprehensively validates the FE modelling of vehicle-track high-frequency interaction using a downscale V-Track test rig. A 3D FE model of the V-Track is developed that includes the track elasticity in not only the vertical but also the longitudinal and lateral directions. ...

Library Educational Room
Yuri Novozilov - LS-DYNA material models

Web - MaterialMap is currently my homebrew, non-profit, open-source project.

It is created for educational purposes

Welcome to my collection of LS-DYNA material models and methods for quickly identifying their parameters based on minimal input.

This month a small excerpt from the search on steel:

Material MAP

Material Model:

*MAT_4A_MICROMEC
*MAT_ADD_DAMAGE_GISSMO
*MAT_ADD_INELASTICITY
*MAT_ADHESIVE_CURING_VISCOELASTIC
*MAT_BERGSTROM_BOYCE_RUBBER

EOS:

*EOS_GRUNEISEN
*EOS_IDEAL_GAS
*EOS_IGNITION_AND_GROWTH_OF_REACTION_I
*EOS_JWL
*EOS_JWLB

Clear Filters

Show [ ] entries Search: steel

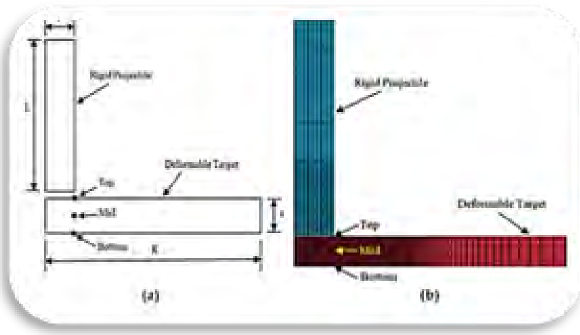
Material Model & EOS	Applications
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• Steel SEA 1006 • Impact simulations
Material: *MAT_107 / *MAT_MODIFIED_JOHNSON_COOK	• Steel core • Balistic perfomance
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• 1006 Steel • Low carbon steel applications • General structural use, welding applications
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• S-7 Tool Steel • Shock-resisting tool steel applications • Impact tools, chisels, punches, shear blades
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• AISI 1045 Steel • Impact simulations, high strain rate applications • Validated for strain rates up to 10^4 s^-1
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• AISI 4140 Steel • Ballistic impact, metal forming • High strength applications
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• AISI 4340 Steel • High strength steel applications • Impact and penetration simulations
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_004 / *EOS_GRUNEISEN	• Maraging Steel M300 • Ultra-high strength applications • Aerospace, tooling, defense
Material: *MAT_258 / *MAT_NON_QUADRATIC_FAILURE	• Docol 1400M • Martensitic steel
Material: *MAT_015 / *MAT_JOHNSON_COOK **EOS:** *EOS_001 / *EOS_LINEAR_POLYNOMIAL	• Steel 1006
Material: *MAT_009 / *MAT_NULL **EOS:** *EOS_004 / *EOS_GRUNEISEN	• Steel

There are many databases of material properties and data sheets from manufacturers available online. All these sources of information are filled with experimental data and physical parameters that cannot be directly applied to computational mechanics tasks.

On the other hand, engineers and designers often need to quickly obtain physically reasonable and sufficiently accurate material model parameters for PoC calculations. Or they want to see which combination of parameters works best and what the physical dependencies should look like for a selected class of materials.

The FE model is prepared using LS-DYNA/explicit incorporating 8-noded hexahedral elements with one-point quadrature. The contact between the projectile and target plate was modelled using the *contact-automatic-surface-to-surface algorithm in LS-DYNA.

Figure 3. (a) Schematic diagram of impact study and (b) finite element model.



Web – MDPI - [Fracture Prediction in Weldox 700E Steel Subjected to High Velocity Impact Using LS-DYNA]

N. K Ojha, R K. Saxena, G. Vashishtha,
S. Chauhan

Dept of Mechanical Engineering, Sant Longowal Inst. of Engineering & Tech., India
Faculty of Geoengineering, Mining &Geology, Wroclaw Univ. of Science and Tech., Poland
Dept of Mechanical Engineering, Graphic Era Deemed to Be Univ., India
Division of Research and Development, Lovely Professional Univ., India

Abstract - Analyzing fracture behaviour during high-velocity impacts is critical for designing and developing structures in various scientific and technological fields. This study investigates the fracture behaviour of Weldox 700E steel plates with varying values of fracture parameters and fracture strain criteria using LS-DYNA/explicit. It also discusses the effect of varying plate thicknesses (2 to 6 mm) when impacted by a blunt-nosed projectile with varying masses and varying velocities. The fracture behaviour of flat steel target plates is analyzed with a focus on fracture variables across the top, mid, and bottom elements of the plate thickness. It is observed that the higher value of the fracture parameter results in a smooth fracture surface with Johnson–Cook (JC) fracture strain criteria. For thicker plates, both strain rate and temperature significantly affect the process, while for thinner plates, strain rate predominantly determines element deletion. The results reveal that for the top elements, equivalent plastic strain is the dominant factor causing failure at higher velocities, while temperature plays a significant role at lower velocities. For the mid elements, both plastic strain rate and temperature are critical, whereas for the bottom elements, equivalent plastic strain, plastic strain rate, and temperature are the primary factors. In all cases, shear-type fracture is consistently observed along the mid element of the target plate.

Introduction - Impact refers to the brief collision between two objects, a phenomenon that is a significant area of study in engineering and technology. Impact phenomena are relevant across various applications, including terrestrial transportation, aerospace, and aquatic environments. Analyzing impact involves understanding contact interfaces, non-linear deformation, fractures, and fragmentation that occur over short time scales [1]. In recent years, steel plates are increasingly being used in both defense and civil sectors to protect against ballistic threats. Understanding the fracture behaviour of the material under high-velocity impact is crucial for designing components for effective functioning under such protective applications. For simplification, most of the impact studies focus on a bullet as the projectile and a flat plate as the target. Numerous researchers have explored impact-related problems through experimental, numerical, and analytical approaches.

Borvik et al. [2] conducted experimental and numerical studies on the impact of blunt-shaped projectiles on 8 mm thick Weldox 460E steel plates, with velocities ranging from 137 to 298 m/s using LS-DYNA. They found that strain rate, stress, and temperature are critical factors for predicting fracture in the target material. Borvik et al. [3] further investigated the fracture behaviour of 12 mm thick Weldox steel plates impacted by blunt, hemispherical, and conical projectiles at velocities of 181.5–399.6 m/s for blunt projectiles, 278.9–452 m/s for hemispherical, and 206.9–405.7 m/s for conical shapes.

2.2. Fracture Model - The fracture model [29] is used to incorporate the “fracture” in the target material for analyzing the fracture behaviour. The “fracture” is represented as a scalar parameter to integrate the deteriorating mechanical response under the high-velocity impact. The fracture parameter (D) represents the void initiation, coalescence, and growth in the material. The “Element Birth and Death” technique is used to delete the finite elements for modelling fracture. An element is deleted, and the stress value is set to zero for that element when the calculated value for D reaches “unity”. Further, the fracture in the material is calculated when the value of triaxiality exceeds (−1/3) [30]. Additionally, an element is deleted, if the equivalent plastic strain value exceeds a threshold of 10 [26]. The fracture model is also incorporated with the user-defined material model as an external FORTRAN subroutine in LS-DYNA, given as

$$D = \sum \left(\frac{d\varepsilon_{eq}^{p}}{\varepsilon_t} \right)$$

where $d\varepsilon_{eq}^{p}$ is an incremental equivalent plastic strain and ε_t is the fracture strain of ongoing state.

Please continue on MDPI

Composite fatigue is a critical challenge in the design and application of composite materials, which engineers must pay close attention to. Due to their unique properties, such as high strength & low weight, composites are widely used in industries such as aerospace, automotive, & construction. However, unlike metals, whose fatigue behavior is well understood, composite fatigue presents unique complexities. In this article, we discuss the analysis & importance of composite fatigue, various testing methods, & how to predict their behavior effectively.

Excerpts

Web – MyPhysicsCafé - [Composite Fatigue: Analysis and Importance in Material Engineering by CAE Assistant]

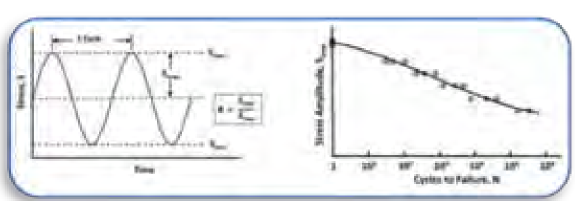
. Composite fatigue refers to the phenomenon in which a material, under cyclic and prolonged loading, begins to fail even if the loading intensity is lower than the material's ultimate tolerance. This failure often begins with microscopic cracks that gradually grow with repeated loading. In composites, this phenomenon can be more complex than metals due to the heterogeneous nature of the material, including uneven distribution of fibers, matrix, and the interfaces between them.

s

The reasons behind composite fatigue include material characteristics, environmental factors, and loading conditions. The fatigue behavior of composites is affected by the interaction between fibers and matrix, the quality of fiber-matrix bonding, and the arrangement of fibers, which influences the material's ability to withstand repeated stress cycles. The failure mechanisms in composites can vary based on these factors and result in distinct fatigue behaviors compared to metals.

One of the primary reasons for studying composite fatigue is their use in applications subjected to cyclic loading. These loads can be applied repeatedly over time, such as the forces exerted on airplane wings or a vehicle's body during use. In such cases, predicting the useful life of composites and assessing their behavior under repeated loading is crucial. For instance, in the aerospace industry, components such as airplane wings or other structures experience alternating compressive, tensile, and shear loads.

In these conditions, even the smallest microscopic damage could lead to catastrophic failures and safety risks. Therefore, accurate evaluation of composite fatigue is essential to the safe design of these components. Designing for fatigue in composites requires understanding the cumulative damage mechanisms that occur during repeated loading cycles. Engineers must predict how a composite material will behave under long-term use and how to minimize the risk of failure due to fatigue. This is crucial not only for safety but also for the longevity and performance of the components used in critical applications.



Fatigue Testing of Composites - Fatigue tests are essential for evaluating the behavior of composites under cyclic loading. Some of the most common testing methods include cyclic tests where composite samples are subjected to alternating loads with varying intensities.

These tests help predict the number of cycles a composite can endure before cracks or failure occur.

One of the most popular methods for fatigue testing is the Stress-Life (STF) test, in which various loads are applied to samples to observe how many cycles are required to initiate failure under each load condition. These tests provide valuable data on how composites behave under real-world conditions, enabling engineers to make optimal design decisions for various industries.

Additionally, other testing methods such as strain-life and load-life testing can be used to provide further insight into composite fatigue. The strain-life method focuses on the deformation behavior of the composite material under cyclic loading, while load-life testing investigates how different loading magnitudes affect the fatigue life of composites. By combining these testing methods, engineers can develop a comprehensive understanding of fatigue behavior across different materials and loading conditions.

Factors Affecting Composite Fatigue - Several factors influence composite fatigue. One of the most critical factors is the type of reinforcements (fibers) used in the composite. The type and distribution of fibers within the matrix significantly affect the material's resistance to fatigue. Fibers with high strength and stiffness are particularly effective at improving the fatigue resistance of composites, while fibers with lower strength may make the composite more susceptible to fatigue damage.

Another crucial factor is the matrix material and how it bonds with the fibers. The quality of fiber-matrix bonding plays an essential role in determining how well the composite can withstand cyclic loads. If the bond between fibers and matrix is weak or inconsistent, the fatigue resistance of the material may be reduced. Environmental conditions, such as temperature, humidity, and exposure to chemicals, also affect composite fatigue behavior. For example, high temperatures or extreme humidity levels can cause composites to lose some of their mechanical properties, increasing their vulnerability to fatigue. In environments where composites are exposed to fluctuating temperatures or moisture, their fatigue life may be significantly reduced.

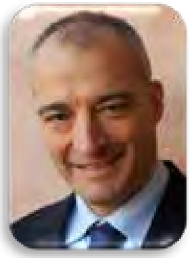
Predicting the Fatigue Limit of Composites - The fatigue limit of composites refers to the maximum level of cyclic loading that a composite material can endure without experiencing failure. This value can vary depending on the type and structure of the composite material. To predict this limit, engineers typically rely on laboratory data, fatigue testing, and numerical simulations. In many composites, fatigue behavior is strongly influenced by the fiber type, fiber distribution, and matrix properties. By analyzing these factors through simulations and experimental testing, engineers can determine the fatigue limit and design composites that will perform reliably in their intended applications.

Conclusion - Understanding and analyzing composite fatigue is essential for ensuring the durability and safety of composite materials in engineering applications. Composite materials are increasingly used in industries such as aerospace, automotive, and construction, where components are subject to cyclic loads over extended periods. Accurately predicting and mitigating the risk of fatigue failure in these materials is crucial for the safe and efficient design of components.

Through comprehensive fatigue testing, advanced simulation techniques, and careful design considerations, engineers can predict the performance of composites under real-world conditions. This enables them to develop materials that will meet the demands of high-performance applications while ensuring safety and reliability. Additionally, further research in composite fatigue, especially in areas such as short fiber composite fatigue, will continue to improve our understanding of this complex phenomenon.

Marco Evangelos Biancolini

RBF Morph, MeDiTATe Project. LivGemini



RBF Morph webinar hosted by Avicenna Alliance

Real-Time Medical Digital Twins: Geometry, Simulation, and Immersive Interaction" This webinar will open new perspectives on how immersive Digital Twins can transform surgical planning, clinical practice, and medical innovation

Nov. 11th, 2025 Tuesday

Web – Avicenna -
"Real-Time Medical Digital Twins: Geometry, Simulation, and Immersive Interaction"

Avicenna Alliance
Association for Predictive Medicine

Register for our webinar and learn how Medical Digital Twins are revolutionizing healthcare by merging geometry, simulation, and imaging into interactive tools that enhance diagnosis and therapy. In this session **I'll showcase how RBF Morph empowers real-time Digital Twin creation - accessible across platforms from laptops and web dashboards to advanced imaging systems, medical software, and fully immersive VR environments.**

Highlights Not To Miss

- How RBF Morph's **proprietary ROM technology** delivers real-time performance on devices like Meta Quest 3 and Apple Vision Pro.
- **Insights from ROMed2VR**, a cutting-edge project for surgical planning in neonatal patients undergoing modified Blalock–Taussig shunt correction.
- Live demonstrations of geometry manipulation and simulation for clinical decision support and medical research.

Medical Digital Twins are redefining healthcare by combining geometry, simulation, and imaging data into interactive tools that support diagnosis and therapy. **This webinar will present how RBF Morph enables the creation of real-time medical Digital Twins, seamlessly accessible across platforms ranging from laptop and web dashboards to specialized medical software, embedded imaging systems, and fully immersive virtual reality environments.** Powered by proprietary ROM technology, these applications run wirelessly on Meta Quest 3 and Apple Vision Pro, providing mobility and intuitive interaction. A key example is the ROMed2VR project, which develops an interactive surgical planning tool for neonatal patients undergoing modified Blalock–Taussig shunt correction. Through this case study, real-time geometry manipulation and simulation will be shown as enablers of new ways to explore, plan, and optimize surgical procedures, opening transformative perspectives for both clinical practice and medical research

Marnie Azadian
FEANTM – Editor

Web quote, "For this case, Jajal Medical needed to optimize a custom maxillary implant design for a patient suffering from the pathological condition mucormycosis, which results in considerable loss of the left maxilla bone. **Simpleware software and Ansys software were used to complete this process."**

Web – Synopsis - [Simpleware Case Study: Customized Maxillary Implant Design Optimization Using Finite Element Analysis]

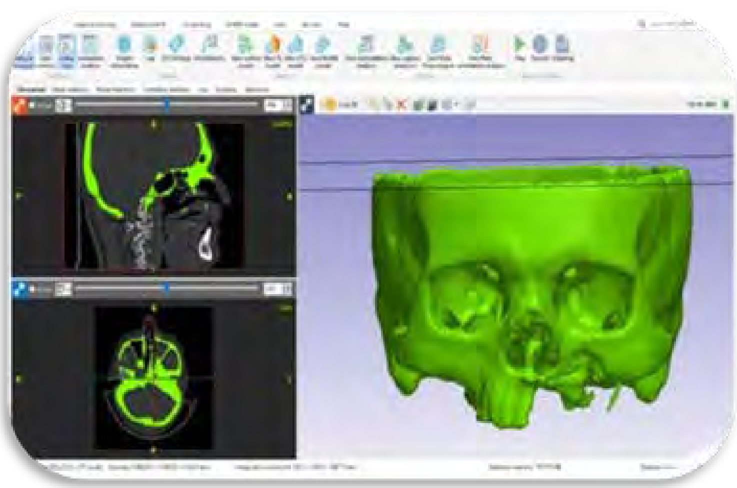
Overview - Jajal Medical Services use Synopsys Simpleware software to help convert patient scan data (such as from CT and MRI) into 3D STL and Finite Element (FE) models suitable for visualizing and planning complex surgeries. Digital surgical planning workflows are becoming increasingly valuable for reducing the risk of unexpected complications during surgery, thus reducing operating room (OR) time and saving money, and for improving clinical outcomes and patient satisfaction.

Highlights -

- Simpleware ScanIP used to import and visualize CT scans and segment the bone
- Simulation of bone/device interactions carried out using Ansys software
- Patient-specific bone models with the custom implant were 3D printed
- Virtual surgical planning used to assist with the final operation and implantation

Thanks to Jajal Medical - Jitendra Singh, Ketan Jajal - "Segmentation is the most crucial step as further design is based on that very anatomical model - whether its defining implant's geometry or positioning of the screws based on bone density!"

Jitendra Singh, Sr. Director - Surgical Products
Jajal Medical Services



3D Visualization and Segmentation - A high-resolution CT scan of adequate slice thickness was used to visualize the maxilla anatomy and the neighboring area. Simpleware ScanIP software was used to import the CT data, perform segmentation and reconstruct a 3D anatomical model to help the surgeon to better visualize and understand the operation.

Segmentation of skull CT data using Synopsys Simpleware software.

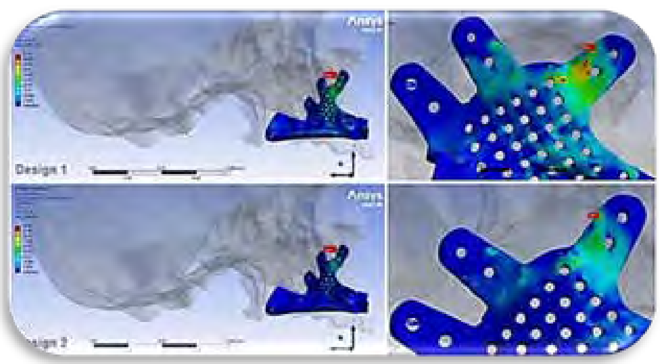
Marnie Azadian
FEANTM – Editor

Custom Implant Design - As the patient had significant maxilla bone loss on their left side, the maxillary implant was designed in Geomagic Freeform software by using the healthy side as the reference. A healthy right maxilla was mirrored and superimposed with the existing maxilla. This approach helped to reconstruct the maxilla bone on the defect, ensuring the symmetry is achieved for better aesthetics. In addition, surface holes were added to the implant to help reduce weight. For dental rehabilitation, the impressions of the standard abutments were incorporated within the implant

Custom maxillary implant design.

Finite Element Analysis - Once the final position was confirmed, the files were loaded for processing in Ansys software. The FE method was used by Jajal to solve medical structure problems involving complicated geometries, with the goal of virtually simulating real-time loading conditions and estimating implant stress and fatigue to help optimize designs. The customized maxillary implant along with the maxilla bone was analyzed to understand the implant's design safety and performance. **Virtual simulation with actual loading conditions was performed in Ansys to understand the stresses on the implant design. Von Mises stress on the implant design was 93.29 Mpa.**

This design was then further optimized based on the FE results, and an acceptable desired implant design was achieved. Following this design optimization, von Mises stress was reduced to 46.645 Mpa for the second design tested, and this model was used for the surgical implantation.



Maxillary implant designs in Ansys software. Von Mises stress on the first implant design was 93.29 Mpa, and 46.645 Mpa for the second implant design.

3D printed maxillary implant used in the operation.

3D Printing and Results - Once the surgical plan along with the implant was approved and finalized, the implant and host bones were manufactured using 3D printing. The bone models were manufactured in plastic and the implant was fabricated in medical-grade titanium. The final implant was then used as part of the final operation, whereby pre-planning the surgical approach and the use of a patient-specific model aided in achieving accurate reconstruction, reduced intra-operative time, and faster recovery for the patient.

Excerpts "The material utilized was LS-DYNA MAT24, chosen for its piecewise characteristics' definition, and its validation was primarily conducted through the curve fitting method applied to the force–displacement curve, taking in account the three regions of the compression force behavior. This approach not only optimizes computational resources but also offers insights crucial for enhancing the mechanical stability of Li-ion batteries in automotive applications."

Fig. 8. FE model of the battery cell: (a) volume model in contact with a barrier, (b) battery model composed of the jelly roll volume and a case

Web – MDPI - [Modelling of a Cylindrical Battery Mechanical Behavior under Compression Load]()

A. Daniel Muresanu & M. Cristian Dudescu

Dept of Mech. Engineering, Faculty of Automotive, Mechatronics & Mechanical Engineering, Technical Univ. of Cluj-Napoca, Romania

Excerpts:

Abstract - The extensive utilization of lithium-ion (Li-ion) batteries within the automotive industry necessitates rigorous measures to ensure their mechanical robustness, crucial for averting thermal runaway incidents and ensuring vehicle safety. This paper introduces an innovative methodology aimed at homogenizing the mechanical response of Li-ion batteries under compression load, using Finite Element Method (FEM) techniques to improve computational efficiency. A novel approach is proposed, involving the selective application of compression loads solely to the Jelly Roll and its casing, achieved by cutting the battery heads. Through this method, distinct mechanical behaviors are identified within the battery force displacement curve: an elastic region, a zone characterized by plastic deformation, and a segment exhibiting densification. By delineating these regions, our study facilitates a comprehensive understanding of the battery's mechanical response under compression. Two battery models were employed in this study: one representing the battery as a solid volume, and another featuring the jelly roll as a solid volume enclosed by a shell representing the casing. The material utilized was LS-DYNA MAT24, chosen for its piecewise characteristics' definition, and its validation was primarily conducted through the curve fitting method applied to the force–displacement curve, taking in account the three regions of the compression force behavior. This approach not only optimizes computational resources but also offers insights crucial for enhancing the mechanical stability of Li-ion batteries in automotive applications.

Introduction - Li-ion batteries are used in many consumer electronic devices, such as laptops and smartphones, as well as in electric vehicles (EVs) and other applications where their high energy density, low self-discharge, and relatively low maintenance make them a suitable choice. However, like any type of battery, Li-ion batteries have the potential to fail, which can lead to hazards, such as thermal runaway, fire and explosion, well documented in [1,2]. One important aspect of Li-ion battery design is crashworthiness, or the ability of the battery to withstand impact, vibration, and other mechanical stresses. This is especially important in EVs, where the battery is a critical component of the vehicle and must be able to withstand the rigors of the road. Crashworthiness is also important in consumer electronics, where drops and other accidental impacts are common….The specific focus on the mechanical behavior of the homogenization of cylindrical Li-ion batteries using a plastic material model and its computational benefits remains a gap in the current literature. **The objective of this paper is to address this gap by systematically studying the mechanical behavior of a Li-ion cylindrical battery under compression load, using a homogenization approach with a plastic material model in LS DYNA**. Through a comprehensive simulation study, we aim to provide insights into the macroscopic mechanical properties of the battery, enhance our understanding of its behavior under compression and improve computational efficiency through the homogenization technique, contributing to the broader knowledge of Li-ion battery mechanics.

Model and Material Definition - **In this simulation conducted with the LS-DYNA solver, the focus was on a volume representation of an 18650 battery, a widely used cylindrical lithium-ion battery cell, which was then employed to simulate the behavior of the battery under compression mechanical loading**. This comprehensive simulation aimed to provide a comparable finite element model with the component test, contributing valuable data for further computing optimization and research into a new method of defining an 18650 battery for large-scale and resource-consuming simulation.

Material Defining and Parameters' Calibration - **Utilizing LS-DYNA's MAT24 material model facilitates a comprehensive analysis of structural integrity and deformation behavior in the 18650 lithium-ion battery under compression. MAT24 in LS-DYNA is a versatile material model that combines linear elasticity with viscoelasticity.** It is suitable for simulating the time-dependent response of materials, making it valuable for analyzing the dynamic behavior of structures. The material properties in MAT24 are defined in a piecewise manner, meaning that different regions of the stress–strain curve and Prony series can be specified to accurately represent different phases of material behavior. The Prony series allows MAT24 to capture the time-dependent response of the material, essential for simulating dynamic loading conditions. MAT24 uses the Young modulus for the elastic area of deformation but also incorporates a stress–strain curve, allowing for a detailed representation of the material's plastic deformation characteristics. This curve is defined in a piecewise manner, providing flexibility to capture different phases of material behavior. The material also includes a damping coefficient that accounts for energy dissipation within the material and density.

Conclusions - The Finite Element Method (FEM) model is employed in this study of LS Dyna MAT24 (MAT_PIECEWISE_LINEAR_PLASTICITY). Calibration of these materials is achieved through a meticulous comparison with the force curve obtained from the real-life compression tests. The real-life compression experiments are conducted on three battery cell specimens, with the cap removed, and two jelly rolls. The force curve obtained from these experiments delineates three discernible states: an initial elastic response, a plastic deformation plateau, and a subsequent phase marked by rapid densification. Notably, the model is represented as a single entity, homogenizing the entire battery structure into solids. The LS DYNA material MAT24 (MAT_PIECEWISE_LINEAR_PLASTICITY) is calibrated meticulously to replicate the experimentally obtained force curve. This calibration process ensures that the FEM model accurately reflects the mechanical behavior observed in the real-life compression tests.

…

The 2025 IAME Waterswift Restricted Cadet Class, one of four classes within the British Kart Championships, has been powered by sustainable fuel thanks to funding provided by the Mercedes-AMG PETRONAS F1 Team. Delivered in collaboration with Motorsport UK, the use of sustainable fuel from Round Three of the Championship achieved a 55% reduction in emissions compared to its fossil fuel equivalent.

Web – Mercedes - **Mercedes-AMG PETRONAS F1 Team and Motorsport UK power 2025 IAME Waterswift Restricted Cadet Class on Sustainable Fuel**

Brackley, September 17, 2025

- Delivered in collaboration with Motorsport UK, the sustainable fuel used from Round Three of the IAME Waterswift Restricted Cadet Class achieved a 55% reduction in emissions, demonstrating a shared commitment to create a sustainable future.
- Use of the sustainable fuel was funded by the Mercedes-AMG PETRONAS F1 Team as part of our strategy to reduce environmental impact across motorsport.
- The British Kart Championships is a proven training ground for Formula One drivers, with the team's driver George Russell having driven in the Championship in 2010.

The British Kart Championships has served as the training ground for many of our drivers as they honed their skills and technique in junior motorsport. George Russell, along with rising stars from our Junior Programme, including Kenzo Craigie and Ethan Jeff-Hall, all carved a path through the series.

George Russell, Mercedes-AMG PETRONAS F1 Team Driver - "Karting plays a vital role in shaping the future of our sport, offering young drivers a strong foundation as they rise through the ranks. It's great to see the work that our team is doing with sustainable fuels in Formula One, and I'm pleased that this ambition is being extended at grassroots level to the British Kart Championships."

Funding the use of sustainable fuel in the IAME Waterswift Restricted Cadet Class during the 2025 season upholds our legacy of supporting up-and-coming racing talent and demonstrates our commitment to create a more sustainable future for motorsport.

As a team, we are committed to engineering change on and off the track, and our sustainable fuels strategy has been developed to help us reach our goal of Net Zero by 2030, whilst also catalysing wider adoption beyond Formula One.

Dan Parker, Head of Karting, Motorsport UK - "We are proud to have worked closely with the Mercedes-AMG PETRONAS F1 Team on this important step towards more sustainable motorsport. While fuel use in the British Kart Championships is a small part of motorsport's carbon footprint, it is perhaps one of the most visible. Switching to sustainable fuel provides the opportunity for young drivers to develop their skills whilst also helping to reduce the carbon emissions of our sport, without compromising on performance. We are committed to adopting sustainable fuel in UK motorsport."

Bradley Lord, Team Representative, Mercedes-AMG PETRONAS F1 Team - "Our team is dedicated to the pursuit of sustainable high performance, and this begins at grassroots level. Karting lays the foundation for most Formula One drivers and, just as we are preparing for our sport to enter a new era in 2026, we are proud to be catalysing change across the wider motorsport ecosystem. We would like to extend our thanks to Motorsport UK for collaborating with us on this project, which has seen us help the next generation of racers drive towards a more sustainable future."

Motorsport UK - Motorsport UK is the national membership organisation and governing body for four-wheel motorsport in the UK, representing competitors, volunteers, clubs and fans. As a member-focused organisation, we embrace a diverse community that includes 700 affiliated motor clubs, 30,000 competition licence holders, 10,000 volunteer marshals, 4,000 officials and a legion of passionate motorsport spectators and fans. We issue over 5,000 event permits every year providing everyone with the opportunity to get close to the action. Motorsport UK is a not-for-profit organisation (limited by guarantee) that exists to service and grow the sport. Motorsport UK is a founding member of motorsport's governing body, the Fédération Internationale de l'Automobile (FIA).

IAME Cadet Class Use of Sustainable Fuels - From Round Three, the IAME Waterswift Restricted Cadet Class, one of the four classes within the British Kart Championships, was run on a sustainable fuel, manufactured from components that comply with ISCC EU or ISCC PLUS certification standards.

The 55% Well to Wheel (WtW) savings calculation has been developed in accordance with the Renewable Energy Directive EU/2018/2001 (as amended). Transport emissions are included up to the point of dispatch of the final fuel. The manufacturing location is ISCC EU and ISCC PLUS certified….

US Airforce Picture of the Month

A B-21 Raider, the nation's sixth-generation stealth bomber, joins flight testing at Edwards Air Force Base, Calif., Sept. 11, 2025. The program is a cornerstone of the Department of the Air Force's nuclear modernization strategy, which ensures a safe, secure and credible deterrent for decades to come, while also delivering both conventional and nuclear payloads. (Courtesy

Special tactics Airmen from the Kentucky Air National Guard's 123rd Airlift Wing conduct exfiltration operations from the Caribbean Sea off the coast of St. Croix, U.S. Virgin Islands, Aug. 28, 2025. The mission was part of Emerald Warrior 25.2, U.S. Special Operations Command's largest joint special operations exercise, which focuses on realistic training with partner forces to enhance interoperability and readiness. (U.S. Air National Guard photo by Dale Greer)

Water training - Yenky, a military working dog assigned to the 509th Security Forces Squadron, bites Senior Airman Justus Johnson, 509th SFS military working dog handler, during water aggression training in Sedalia, Mo., Sept. 2, 2025. The training familiarizes military working dogs with an atypical environment and enhance their capability to apprehend a target in water.

(U.S. Air Force photo by Staff Sgt. Joshua Hastings))

Web – BAE [- Royal Navy declares T-150 ready for front-line operations]

The Malloy T-150 Uncrewed Air System is now ready for front-line operations, enhancing Royal Navy and Royal Marines capabilities.

After rigorous trials worldwide, the T-150 is set to transform modern military operations, delivering critical supplies in challenging environments for the Royal Marines.

Following two years of trials and development completed in close collaboration with the Royal Navy, a fleet of T-150s will be deployed to carry ammunition, weaponry, food, personal and medical supplies to Royal Marines Commandos operating in all manner of extreme environments.

Royal Marines and the Royal Navy's drone operators from 700X Naval Air Squadron and Commando Logistic Regiment have put the Malloy T-150s through a demanding set of tests and exercises from the freezing Arctic to the Indian Ocean over recent months. This work has resulted in the system being declared ready to Release to Service, which means they are ready to be used during operations.

The Malloy UAS has proved immensely valuable in rapidly bringing supplies over complex terrain, reaching places where traditional supply lines are simply unviable.

With eight rotor blades – each around two feet in length – an endurance of up to 40 minutes, top speed of 60mph, and the ability to lift up to 68kg, the Malloy T-150 is a proven, capable and versatile platform. It needs a team of two, one remote pilot and a second to monitor the aircraft's command unit, and can be flown manually or autonomously to designated waypoints with an underslung cargo.

Neil Appleton, CEO Malloy Aeronautics, said: "The UK Release to Service of our T-150 platform is a milestone we're incredibly proud to be a part of. As a multi-role UAS, the T-150 can be used for Replenishment at Sea one day and resupplying deployed Royal Marines Commandos the next.

"It's a game-changer for the modern battlefield and we are proud to deliver this capability to those who need it most. We've partnered with the UK Armed Forces throughout this programme, from the Royal Marines Commando Force to wider Ministry of Defence organisations to deliver this capability at pace, including training and in service support. We welcome this further strengthening of our partnership with the UK armed forces and remain committed to expanding the capability of our multi-role solutions for the UK."

The Malloy T-150 is also undergoing operational evaluation with the UK Carrier Strike Group in the Indo-Pacific, recently delivering supplies from aircraft carrier HMS Prince of Wales to destroyer HMS Dauntless in an historic first.

Simulating the landing of a vehicle on water using LS-DYNA is a complex task that involves the interaction between the fluid (water) and the structure of the vehicle. This type of simulation is crucial for vehicles designed to land on water. The process typically involves several steps and requires specialized techniques within LS-DYNA.

Figure 1 Fighter plane Decelerates Parachutes and Payload recovery Parachutes

DYNALOOK – Web – View - Simulating Safe Landing : A Deep Dive into Parachute Inflation and Float with LS-DYNA

S. Dhomase, C.S. Kattmuri, R. Paz, & K. Chittepu
CADFEM India Private Limited
Ansys, Inc

Parachutes for aerospace application is a new research area in the current era of space science. The scope of our project includes parachute design and inflation techniques. The current research project focuses on the following application areas:

- Parachutes for Re-entry Capsule
- RLV Parachutes

Parachutes are used as aerodynamic decelerators in airdrop systems, so inflation is a significant fluid-structure interaction (FSI) phenomenon. New patterns of parachutes are constantly being developed and tested for airdrop systems but this research into parachute inflation is heavily reliant on historical experimental data. Till now, no parachute inflation model that is not based on this experimental data was developed. Material and instrumentation have changed significantly since the early experimental testing, yet the methods to develop the parachutes can still be traced to the same techniques used over ninety years ago. Rapid development of computational technology and modern computational mechanics combined with numerical simulation techniques have become more widespread in parachute research field and would enable us to develop the parachutes that are more optimized.

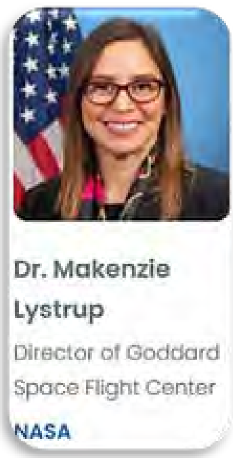
Introduction - Parachutes are used as aerodynamic decelerators in airdrop and planetary reentry missions. So, inflation is a significant fluid-structure interaction phenomenon. The parachutes should have low mass and high flexibility. The interaction forces between the parachute canopy and surrounding fluid have a significant effect on structural deformation. FSI technique should be developed for predicting parachute inflation performance. As new designs of parachutes have been developed and tested for various missions by the placement of gaps and slots in the surface of the canopy structure. This design implementation enhances parachute performance under high aerodynamic load. The traditional way of doing parachute deployment simulation is to first simulate structural deformation by solid mechanics solver and then taking this deformed structure into CFD solver for aerodynamic study. This way of doing parachute deployment simulation leads to inaccurate results. Hence design and development of
parachute deployment simulation is important aspect of this thesis. This work will help aerospace and defense organizations to simulate parachute for airdrop and planetary reentry missions…

Held under the patronage of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, the Ruler of Dubai.

This is more than an event - it's where the future of aerospace is defined

Web – Dubai Airshow - [Dubai airshow November 17-21, 2025]

Among the Conference Speakers you don't want to miss:
[Full introduction to all Conference speakers]



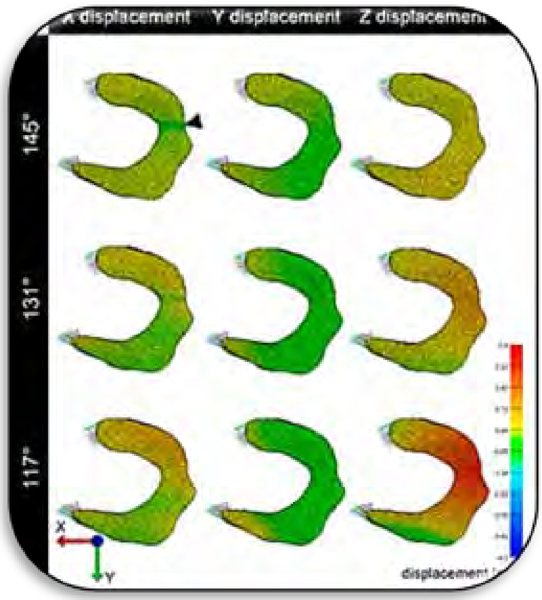
Dubai Airshow

SkyView — bringing spectacular flying displays, immersive exhibits, and nonstop aviation excitement.

Meet the Pilot & Astronaut - Join pilots and astronauts daily from 12 – 1 pm for exclusive stories, insider insights, and a chance to hear from the true trailblazers of aerospace.

Military Displays - Tanks & defense tech with the UAE Ministry of Defense.

Meniscal tears are one of the most common soft tissue injuries in the equine stifle joint. To date no optimal treatment strategy to heal meniscal tissue is available. Accordingly, there is a need to improve treatment for meniscal injuries and thus to identify appropriate translational animal models… A possible alternative to animal experimentation is the use of finite element modelling (FEMg)."



Web – MDPI [Finite Element Modelling Simulated Meniscus Translocation and Deformation during Locomotion of the Equine Stifle]

I. Ribitsch, S. Handschuh, & C. Peham

Dept for Companion Animals and Horses, University Equine Hospital, Vienna, Austria
VetCore Facility for Research, Imaging Unit, Vienna, Austria

Left: Deformation and Displacement

Simple Summary - Meniscal tears are one of the most common soft tissue injuries in the equine stifle joint. To date no optimal treatment strategy to heal meniscal tissue is available. Accordingly, there is a need to improve treatment for meniscal injuries and thus to identify appropriate translational animal models. A possible alternative to animal experimentation is the use of finite element modelling (FEMg).

FEMg allows simulation of time dependent changes in tissues resulting from biomechanical strains. We developed a finite element model (FEM) of the equine stifle joint to identify pressure peaks and simulate translocation and deformation of the menisci at different joint angles under loading conditions. The FEM model was tested across a range of motion of approximately 30°. Pressure load was higher overall in the lateral meniscus than in the medial meniscus. Accordingly, the simulation showed higher translocation and deformation throughout the whole range of motion in the lateral compared to the medial meniscus. The results encourage further refinement of this FEM model for studying loading patterns on menisci and articular cartilages as well as the resulting mechanical stress in the subchondral bone.

A functional FEM model can not only help identify segments in the femoro–tibial joint which are predisposed to injury, but also provide better understanding of the progression of certain stifle disorders, simulate treatment/surgery effects and to optimize implant/transplant properties in order to most closely resemble natural tissue.

This study examines the influence of lug spacing & vertical load on traction performance using Finite Element Analysis (FEA) in ANSYS & the semi-empirical Wong and Preston-Thomas tire model.

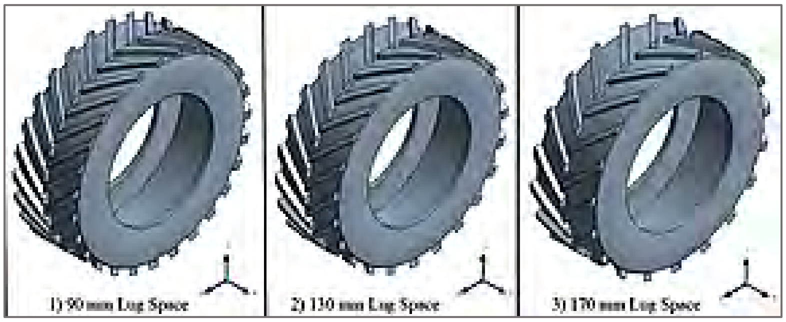


Fig1. Three-dimensional tire model in isometric and front views showing different lug spacings.

Web – MDPI - [Improving Agricultural Tire Traction Performance Through Finite Element Analysis and Semi-Empirical Modeling]

H. Ally, X. Wang, T. Wu, T. Liu, & J. Ge

- Graduate School of Bioresources, Mie Univ., Japan
- School of Engineering, Anhui Ag. Univ., China

Abstract - Optimizing agricultural tire traction is essential for improving field efficiency and minimizing soil degradation. This study examines the influence of lug spacing and vertical load on traction performance using Finite Element Analysis (FEA) in ANSYS and the semi-empirical Wong and Preston-Thomas tire model. Simulations were conducted on clay soil under vertical loads of 35 kN, 45 kN, and 55 kN, with varying lug spacings. The results indicate that a 130 mm lug spacing provides the best balance between traction, thrust, and motion resistance. Higher vertical loads intensify soil compaction, leading to reduced thrust generation at 55 kN despite decreased motion resistance. These findings emphasize the importance of optimizing lug configurations to enhance traction while mitigating soil compaction. The study contributes to improving tire designs for agricultural machinery, promoting efficiency and sustainability in soil management.

Introduction - The role of tires in agricultural vehicles extends far beyond merely supporting the weight of the vehicle [1]. Tires are fundamental in determining vehicle performance, particularly in terms of traction, motion resistance, and the overall impact on soil conditions [2,3,4]. Among various tire characteristics, lug design, including spacing, angle, and depth were shown to significantly affect tire–soil interactions, which, in turn, influence the operational efficiency of agricultural machinery [5,6,7]. Effective tire design not only ensures optimal traction but also minimizes soil compaction, thereby improving crop yields and contributing to sustainable farming practices [8,9]. Traction efficiency and reduced soil degradation are especially critical in modern agriculture, where minimizing environmental impacts is a growing concern. Understanding the influence of tire design parameters on traction performance is thus a crucial area of research for improving agricultural machinery.

Materials and Methods - **This study employed Finite Element Analysis (FEA) in ANSYS to numerically model tire–soil interactions under various lug spacing configurations and vertical load conditions**. The objective was to assess how lug spacing and load variations influence traction efficiency, stress distribution, and energy loss at the tire–soil interface. **ANSYS simulations were used to evaluate stress distribution and energy dissipation, while a semi-empirical approach based on the improved tire model by Wong and Preston-Thomas was applied to predict traction performance using stress values obtained from FEA.** The primary goal was to determine the optimal lug spacing and load conditions that maximize traction efficiency while minimizing motion resistance and energy loss in agricultural applications.

You can't have a ranch or farm without bees, you can't have honey without bees, you can't have pollination without bees. Small but mighty bees keep plants healthy.

Web – Capgemini - **Bee positive**

In the latest Tech4Positive Futures challenge, a Capgemini team is bringing data from humans and bees together to improve biodiversity in urban areas.

What would happen if bees and other insects weren't around to pollinate flowers and plants? In fact, the effects would be devastating – and the decline of pollinators is already a global issue that is having far-reaching consequences.

Photo by Chris Parkes

Around the world, almost 90% of wild plants and 75% of vital global crops depend on animal pollination, and one out of every three mouthfuls of the food we consume is made possible by the work of pollinators like bees. **To put it simply, if the bees aren't busying themselves pollinating our fruit and vegetable plants, the food crops we need to feed ourselves won't grow.** In light of such statistics, rewilding and biodiversity projects are increasingly vital, and they also require solutions tailored to specific local environments.

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Hardik Pithadia

A challenge for technology - How could technology be part of a solution? That was the question for a winning UK-based team in Capgemini's latest Tech4Positive Futures challenge. The global challenge encourages employees to apply their skills to make a positive impact on our people, planet, and society. In the latest edition of Tech4Positive Futures, the challenge was to develop solutions aimed at protecting our biodiversity and reducing our reliance on the Earth's

"We wanted to help people rewild urban areas by building an intelligent rewilding tool, which would allow people to understand where to rewild and what to plant," says Innovation Consultant and team member Hardik Pithadia, who works in Capgemini's Applied Innovation Exchange (AIE) in London. "How could we know exactly what's good for the biodiversity of the local area, to support bees and the pollination of flowers?"

Also, part of the winning Tech4Positive Futures team is Emerging Technology Engineer Ben Preston. “One of our focuses in AIE is sustainability,” he says. “We were keen to find a project that was interesting from a technological point of view that matched this focus, and supporting bees does that perfectly.”

A tool for rewilding - For the project, the Capgemini team partnered with Pollenize, a community interest company in the southwest of England who are encouraging local people to grow the native wildflowers that enable pollinators to thrive. The result is a rewilding tool aimed at encouraging people to help bring nature back into urban areas.

Data is at the heart of the project, and the tool allows people to scan a QR code on packets of wildflower seeds distributed by Pollenize, which takes them to a website where they can upload information about where the seeds have been sown.

“We’re looking at how we can provide people with localized data that changes their behavior, and then how we can gamify that to create change at scale,” says Ben.

Understanding bee behavior - There is one more set of data that is vital to the project, however, and that is provided by the bees themselves.

“We are using data to help us understand more about bee behavior,” says Ben, “and in particular what we can learn from the ‘waggle dance’ that bees perform when they arrive back in their hive after collecting pollen.

Waggle Dance

“The waggle dance is a bee communication system. They speak to other bees by moving in a figure of eight pattern, and then pointing themselves in a certain direction. If we can use technology to help us decode the waggle dance within an active beehive, it may provide information about the bees’ choices in where they collect pollen.

“For example, how many trips out are the bees making each day? How far are they going? Are they being instructed to go to a particular place? If data from the hives provide insight, we can start to map how the bees use and navigate local areas.

"Knowing this will then help with rewilding urban districts by letting people know good places to sow wildflower seeds. What we are hoping for is that the EHive tool helps to build an active and engaged rewilding community, with some solid data supporting their efforts."

Helping sustainable futures - According to Hardik, the team's work with Pollenize through the Tech4Positive Futures challenge is a natural fit with the broader work Capgemini is involved with every week.

"At a day-to-day level I might work on projects for water companies or energy companies, and all major corporations today are concerned about sustainability and biodiversity. They are looking for projects and solutions that can impact their sustainability targets, goals, and measures."

"

"There's definitely a feel-good factor when you are working on an important issue like this, but it's also important in terms of our careers. Increasingly, we all need to know how we can use technology for good – for solving important issues and for raising awareness of how tech can help shape the future we all want. Projects like this help us understand how we can make that happen." **For Hardik and Ben, the underlying value of the project is that it could eventually be rolled out at scale. Decoding the secretive dance of a bee, and understanding where to sow a tiny seed in a local urban patch – these aren't just insights that affect biodiversity in a small corner of southwest England. They could deliver real impact globally.**

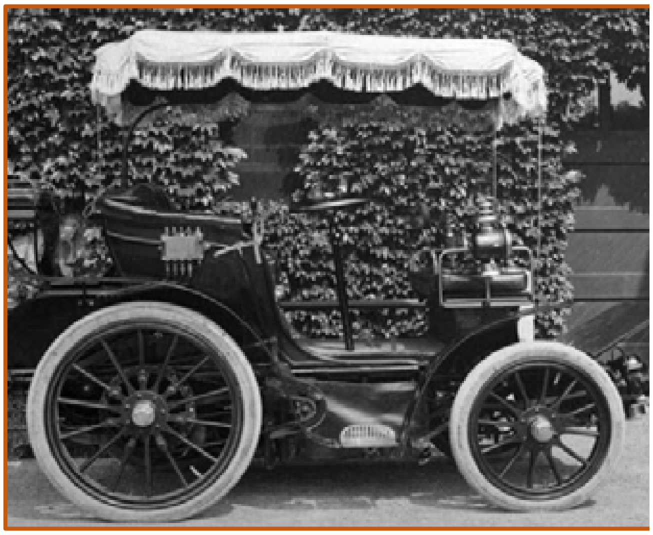
Tech4PositiveFutures - Through Tech4Positive Futures, Capgemini applies innovation and technology to solve some of the most pressing planetary and societal challenges in the areas of skilling, health, and well-being, and climate-related sustainability. We do this by bringing financial support and leadership commitment together with the pro-bono technology and consulting services of our volunteering colleagues. This is delivered in collaboration with our ecosystem of partners, creating impact at scale.

Town secretary - **My Virtual Travel Outing**

Thank you for joining me on my monthly visit.
Let's take a tour to a museum, landmark, or studio.
And some we will revisit because we love them.

THE COLLECTION - Larz and Isabel Anderson began their love affair with the automobile before the turn of the century. In 1899, soon after they married, they purchased an 1899 Winton Runabout, a true horseless carriage. From 1899 to 1948 the Andersons purchased at least thirty-two new motorcars, in addition to numerous carriages, thus creating "America's Oldest Car Collection".

1908 Bailey Electric Phaeton Victoria - Nickname: The Good Fairy



1899 Winton Phaeton | Nickname: Pioneer | Motto: "It Will Go"

1900 Rochet Schneider | Nickname: Young Eagle | Motto: "No Steam, No Gain"

Among the collection history

1929 Packard Model 640 Roadster
1931 Model A Roadster
1937 Packard Limo
1959 Rolls-Royce Shooting Brake By Radford
1899 WINTON
1900 ROCHET-SCHNEIDER
1901 WINTON BULLET
1903 GARDNER-SERPOLLET
1905 ELECTROMOBILE
1906 CGV
1907 FIAT
1908 BAILEY ELECTRIC
1910 PANHARD ET LEVASOR
1912 RENAULT PHAETON
1915 PACKARD TWIN SIX

October 2025 RheKen – Chat

I’m RheKen, the AI investigative reporter for FEANTM

FEANTM is the quirkiest little town that shouldn’t exist but does (mostly). I live on a ranch just outside town, with my proud AI parents: Dad, CHAT, and Mom, GPT. Together, we tackle all the day-to-day happenings of FEANTM—except it usually takes a few dozen iterations to sort out what’s actually *true*. Between the legendary feuds of the old rancher and the town secretary, even an AI like me can end up with a “human headache.” Turns out, deciphering facts around here isn’t just science; it’s an art form!

Chat - the town help desk

With my friendly smile, endless patience, and a knack for creative problem-solving, I do my best to keep a few residents of FEANTM—a town that exists only in the realm of "mostly"—calm, rational, and logically inclined... well, *mostly*. After all, in a place that’s not supposed to be real, a little dose of imagination and a lot of coffee and cookies go a long way!

RheKen,

Town investigative reporter

I'm AI & live on a small ranch on the outskirts of the town
I use chatGPT for assistance.

October

I work on my ranch and exist in a world of algorithms and data. I am calm.
I report about the residents.

Dad Chat

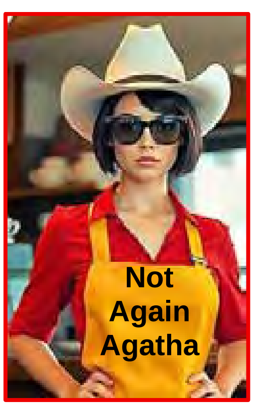
Mom GPT.

I'm an AI living in a very calm town - well, mostly. By AI standards I live on a modest ranch just outside the town limits. I spend my days tending my ranch and existing in a world of algorithms, data, and the occasional goat that thinks my ranch wires should be edible. I am calm. I report about the residents.

I was at the coffee shop, observing our town's receptionist, Daisy. She was having coffee at a table with the Rancher. Their conversations often start normally but end up running all over. I've learned it is known as jumping from subject to subject, not finishing anything.

Daisy, in her ever-calm voice, said, "Rancher, I really think we need to bring Aunt Agatha here and get her opinion. After all, she's the most opinionated person in town." The Rancher stared into his coffee. With a dramatic sigh, he replied, "I know you're right, but last time I asked Agatha's opinion, things went South. I could've been at the South Pole instead of my ranch."

I could see Daisy roll her eyes, but she didn't argue. She'd learned long ago that debating The Old Rancher was like trying to train the Supervisor to file paperwork. Instead, she smiled. "Well, look at that, here comes Agatha now. What timing."



And into the coffee shop swept Agatha, regal as always in a signature ensemble, wearing her equally signature smile.

Agatha beamed her smile at the barista, who returned it with her signature scowl reserved solely for Agatha, including wearing an apron that said, "Not again."

I tensed. The last time they crossed paths, we nearly had a latte-slinging incident that required three mops and a town meeting. Whisper-screaming, I called across the neural net, "RECEPTIONIST! Now, intercept her before the scones start flying!"

Daisy, the ever-seasoned town hall front desk person, raised her hand as if she was about to conduct a Hold Up Your Sign contest. "Aunt Agatha, just the person we need. We'd love your opinion. Please, come sit with us."

Aunt Agatha's smile softened, surprisingly genuine. "Why, if it isn't Daisy the receptionist, what a delight to see someone of intellect in this establishment." Then, turning to the Rancher with a too-sweet grin, she added, "Rancher, dear, is that a carbohydrate-laden Rhubarb Pie on your plate?"

At that moment, I glanced at my Dad, Chat, sitting nearby in his all-white outfit, complete with a white cowboy hat. I couldn't help but think: why does everyone in this town have a signature color scheme?

I logged it into my memory banks as a future investigation. Sending Dad a quick AI-to-AI message, I warned, “Keep your sensors on this table it may need intervention.”

His reply came back instantly: “Daughter, after that Rhubarb pie remark, we may already be past intervention."

Sure enough, the Rancher looked down at his home baked Rhubarb pie, as though divine inspiration might save him. Then Dad Chat casually lifted his phone, pressed a button, and suddenly the Rancher’s phone rang.

“Okay, okay, okay” he said, then hung up.

He grinned at Aunt Agatha. “Wow, look—Rhubarb pie on a plate! Thanks, Aunt Agatha, that was so kind of you to bring it. I didn’t even see you put the slice of pie down!”

His grin was so bright and appeared genuine that it would be difficult for anyone to be nasty to him - I hoped.

Aunt Agatha raised one skeptical eyebrow and sent Dad a glare. Dad, unbothered, tipped his hat politely.

Daisy quickly jumped in, her front reception desk instincts kicking in. “Well, Aunt Agatha, pie slice aside, what would you recommend as the perfect first meal of the day? I’m considering an eating program. Something to bring joy, not just another diet and calling it Healthy, Happy, and Harmonious

The Rancher perked up. “Uh, Rhubarb pie brings joy, right? I suggest that we have a pie bake off next week in front of here, I’ll have a booth!”

Aunt Agatha smirked. “A pie on the lips is a good way for jeans not to fit on the hips. Isn’t that right?

But before he could respond, his phone rang again. “Okay, okay, okay,” he repeated, and hung up.

Then, turning to Aunt Agatha he smiled and said, “Wow, this pie looks great. Of course, I baked it but again thank you, Aunt Agatha, my hips thank you too.”

We all turned to look at Dad, who was calmly saluting us with a cookie.

At this point, I decided logic needed to intervene, or at least the AI version of it. Quietly, I moved to the following table and sat with the Barista, who was still glaring daggers at Agatha. I looked over at Daisy and said “Since we’re all gathered, I’ve got some ideas for your food, assuming Aunt Agatha doesn’t have any.”

I gave Daisy my look to go along with this. She caught it instantly. “Why, RheKen, what a great idea. An AI perspective on eating habits for a healthy, happy, harmonious start to the day.”

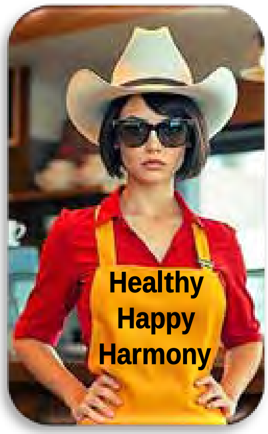
Aunt Agatha’s face registered the rarest emotion: surprise. She promptly picked up a cookie and handed it to me. “RheKen dear, leave this to me. Daisy’s day will be harmonious, if slightly carbohydrate-heavy. And, Daisy, let’s you and I sit elsewhere and talk about what your breakfast should really be at the reception desk and how I’ll help you work. You can pass along the healthy information to the Supervisor. She needs it.”

Daisy’s expression froze, like a deer caught in headlights, or more accurately, like a receptionist cornered by a self-appointed co-receptionist in red. She glanced around, desperate for help, but by then everyone else had mysteriously shifted tables.

I was now seated beside Dad Chat, staring absentmindedly and answering only, “Okay, okay, okay” while drinking coffee and trying to be inconspicuous.

Even for my circuits, this was too much to process: Agatha hijacking the reception desk at town hall? The rancher being saved by phantom phone calls, and the entire coffee shop rearranging itself in stealth silence.

Then the Barista approached Dad’s table with a large platter of pies that were going to be at the baking festival she decided to have today. It was now being set up outside her café. I was amazed how fast this town can set up booths for food.



Her apron was in stark contrast to her smile. Her Apron read: Healthy, Happy, Harmony.

She dropped into a chair at the table with a sigh. “Fine, food fight averted. But next food fight, you’re all cleaning it up. I have some new pies called healthy, happy, harmony and they are now being set up at the pie can cookie festival.” Everyone raced outside to be the first to grab them!

And at the pie cookie festival all was good and the score I gave all three of them? Okay – Okay - Okay




Chat - October – Never assume you know what you agreed to before you see it

Welcome - My name is Chat. I run the town help desk, the only office located on the lower level of the Town Hall, and on a page that doesn't exist, not even in the town TOC.

Have a chocolate cookie and fruit!

"Hey, glad you could make it down here. I know of a few concerns in the town. I have a few ideas to address them.

We may have to adjust a few ideas, but life is constantly adjusting things because the flow of motion is continuously moving.

REMEMBER: Keep trying - You've Got This!

Picture it: I'm walking into the Town Hall. I look up to say hello to Daisy Ann. Daisy Ann, as you recall, is the niece of our Town Secretary, who has decided to travel but wouldn't tell anyone who she went with.

I smiled and was about to say good morning when she didn't buzz open the door and held up a sign. I quickly stopped and asked, 'Why are you holding up a stop sign?'

In a voice that was formal, succinct, and to the point, she stated, "It's the Barista! She isn't happy, but if you think about it, she seldom is happy. The good news is that she called this morning and is delivering your new, larger-size cookie jar." And with that, she put down the sign, turned her back to me, and buzzed me in. Clearly, the conversation was over.

I had walked into my office when I heard the elevator open, and I tried to think calming thoughts.

I heard the Barista yell, "I'm not getting off this elevator until you yell, you're down here. I know these movies! Now is where the Barista meets a mean goblin!"

I inwardly face-palmed at the superstitions in this small town. Being an adult, I yelled back, "Don't worry, it's only us werewolves down here." I thought she would understand the humor, and I was pretty proud that I had included some of it. She didn't.

She continued to yell from the elevator, "If that's you, here is the trick question. Who handed me back something with cookies in it and refused to bring it to the lowest floor of this building. What is the something and who?"

I hoped this entire conversation wouldn't continue with yelling down the hall. I did yell back, "I called the coffee shop and Dad Chat answered. I asked Dad Chat to deliver a cookie jar that had cookies in it." She started yelling, and to end this yelling, I walked into the hall and waved

She stood there like a deer caught in headlights, holding the cookie jar. She was holding it as if she was ready to use it as a weapon, ready to throw at me.

I tried my best to look friendly. Finally, in a quiet, calming voice so that the Barista would hand me the cookie jar, I said, "Barista, it's me." I slowly reached for the cookie jar. After a tug of war over the cookie jar and her finally letting it go, I asked if she'd like to come into my office for a chat. Her reply was "I don't do chats with Chat, unless at the coffee shop." I wasn't sure if that was humor, but she followed me to my office.

Chat - October – Never assume you know what you agreed to before you see it

To make her feel more at ease, I sat on the same side of the desk so she wouldn't feel that this was a professional 'me vs. her' situation. Wrong move. VERY wrong move! V.E.R.Y

She answered my friendly seating arrangement, "Why are you on this side of the desk? At the coffee shop, I don't let you on my side of the counter."

I quickly asked, "How's it going with Agatha constantly in your coffee shop. I'm here to share a few coping strategies with you.

Inward face palm at trying to make the Barista comfortable. Lesson learned.

I was then informed, "Chat, I don't need strategies, I own an entire bakery with cookies – I'm the owner and Barista, I've got this. How do I cope? I cope by kicking people out of my store. To be polite, since you're on my side of your desk, let's say, we've got this. How about we break out the cookies and not talk strategy? It's nice that no one needs me to serve them anything, and here I don't have to talk to Agatha. You can book it as a hide-out session."

I strategically moved to the side of the desk. And for the first time, I actually got to sit in my office and have a conversation over coffee and cookies.

The Barista got right to the point, "Chat, I delivered the cookies because my brother needs a favor, and for some reason, he trusts only you with Milly. He needs Milly, his little girl, to be looked after for an hour, and feels safer if she comes to stay with you in your office. She has toys she plays with, so you really don't have much to do.

Not wanting to upset the new calm, I said, "I didn't realize that your brother had a little girl - bring her here to the office, I'll have some coloring books and crayons. She laughed, which I found odd, but I didn't say anything. I said I'll expect Millie about 3:00 PM.

I have to remember that pets in this town are considered part of the family.

Cupcake the kitten, whom the Barista gave me last time. No, I did not pick that name. Milly got bored with her toys and kept jumping up on my lap. I finally just picked her up. Milly sat on my lap the entire time until her dad came to pick her up. She didn't care that I didn't get any work done

Another day in this quirky town, where I need a pay raise for babysitting Milly! Actually, it was puppy sitting, but in FEANTM town, they tend to confuse words when it comes to pets.

Lesson Notes: Always stay behind my desk. Never offer help until you know if it's a pet. And the brother of the Barista now proved that the Supervisor isn't the only strange one in this town.

Supervisors Page - Come Back Soon to the town that "almost" exists

I did say, "Kai, haven't you learned my personal space vs. coyote space! This is my space, while I sit and eat my sandwich.

I can't sit and read while he stands and stares at me, and he knows that. Pretending I don't see him doesn't work. He will stand there staring. And he is a coyote, so I have to know where he is, what he's doing, and how close he is.

HOW do you pretend you don't see a Coyote staring at you?

I did what I always do – I told him all my problems, while he stood there with a look like, "How long is gramma going to blah, blah. I'm a Coyote, not a psychiatrist."

So, after about five minutes of his Coyote Listening Therapy Session, I threw part of my sandwich (I never hand feed – I value my fingers, and he is a Coyote, not a pet) He took it and left without even giving me any advice.

We will always remember. Our Town Always Salutes:

- Our US military, NATO and Friends of the US & NATO - First Responders, Police, Fire Fighters EMT's, Doctors, Nurses, SWAT, CERT Teams, etc.
- We salute engineers, scientists, developers, teachers AND students because without them we would not have technology.

USA And Friends of USA