



**Monthly Town Hall Meeting**  
**Engineering, Blog, Gossip & News**  
[www.feantm.com](http://www.feantm.com)

Airport



Airport



Automotive



Research Hospital



Research Hospital



Museum



Charlotte



Marold



Kathleen



RheKen AI Reporter



Marta & Seppi



Rasmus



Shweta



Syn



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Editors: (alpha order) Anthony, Art, Marnie, Marsha, Shweta, Yanhua

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."**

**They are all brothers - strange family**

Contact us at [feaanswer@aol.com](mailto:feaanswer@aol.com)

[Map Vector & town graphics in our magazine are courtesy of vecteezy](#)

# *Table of contents* All postings &/or articles are copyright to the respective person/company

- The websites noted will have the complete articles, and higher resolution graphics/videos.
- We reference and link to the source of information.
- This blog/magazine/town is a positive venue for informational purposes.

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March 2023 - Name of the person the town thanks

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21	<b>YouTube</b>	Exhibitors	This month: HEXAGON - LANCEMORE - OZEN - OASYS

Automotive and/or Racing Information

22	<b>BMW</b>	Launch of the BMW iX5 Hydrogen pilot fleet.
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Thanks to [Vecteezy](#) for our **Map Vector/town** and many of the graphics in our magazine

# *Table of contents* All postings are copyright to the respective person or company

First named person the town thanks

## Airport – Aerospace - Military

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24	<b>BAYKAR</b>	TB2 s (UCAVs) are aiding earthquake relief efforts in Turkey's south.
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26	<b>News &amp; Air Force</b>	USAF - Pictures of the month

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## Goodbye Page

This blog/magazine is a positive venue, for informational purposes, and not revenue

**TOWN HALL MEETING  
FREE COFFEE**

**Park Cars behind building**

**Tie horses to hitching rails**

**Serving coffee & cookies, all kinds!**

**Our town comprises individuals interested in solutions and, of course, animals and children.**

**Gossip is at the local coffee shop.**

**Pets are welcome. (Small pets, horses stay outside)  
(Pet goats or pigs also stay outside)**

**This month we combined sections.**

**The town had time constraints. This was due to a town medical emergency.**

**We hope to be back with complete town information with the April or May edition.**

**Announcements – What Not To Miss In This Issue**



**Newsletter:** The very first HANS (the new Human Body Model from DYNAmore.)



**Article:** Designing vibration damping with Ansys Mechanical



**Case study:** Short Fiber Reinforced Plastics - Verify the strength of thermoplastics components with LS-DYNA and Moldex3D



**Publication:** An image-based approach for the estimation of arterial local stiffness in vivo published in the Frontiers in Bioengineering and Biotechnology journal in collaboration with the MeDiTATe-project





# Town Map



- \* The logos displayed, of content in our magazine, do not represent their endorsement.
- \* To be removed, please notify [feaanswer@aol.com](mailto:feaanswer@aol.com) with the request.
- \* Your town lot will be auctioned, with the Town applying all proceeds to the coffee budget.
- \* The town map changes pending information, and rotational building rentals.



The next half-day of information will be in March 23 on Mechanical connections.

Thanks to your answer to our poll, the topic has been settled. Please join us on March 23 at 2:00pm for our free webinar on Mechanical connections.

**More information here: InfoDay — [LS-DYNA and services from DYNAmore Website](#)**



### DYNAmore France

The 2023 French events and courses are available on our website.

You will find all our French training courses. Online webinars as well as on site courses in our premises in Versailles are proposed.

Free information webinars are also offered on specific topics related to customer needs.

**Our 3rd French LS-DYNA User Day will occur.**

Our full seminar brochure -download at: <https://www.dynamore.eu/en/homepage-news/eu/brochure-2023>

Evènement / Formation	Février	Mars	Avril	Mai
Introduction à LS-DYNA		27-29 (compacte*)		10-12
Introduction à LS-PrePost	02			
Introduction aux technologies de la simulation	09			23
L'analyse implicite avec LS-DYNA		09-10		
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La méthode ALE et le couplage fluide-structure dans LS-DYNA				
La méthode SPH (Smoothed Particle Hydrodynamics) dans LS-DYNA				
Demi-journée d'Information		23		
3ème Journée Utilisateurs LS-DYNA France				

Toutes les formations ont lieu dans nos bureaux à Versailles.

\*Formation en ligne



**Did you miss what Brian Winters wrote?** “Those in the manufacturing industry completely understand that the ability to obtain accurate measurements is directly tied to product quality and customer satisfaction.

The reality is that the measurement devices you choose can significantly impact your manufacturing success — and that’s why it’s so important to choose Hexagon’s manufacturing intelligence division of solutions that deliver decades of expertise to ensure your journey to manufacturing success is met.

#### EXCERPTS

#### [Measure twice, cut once: Ensure parts meet specifications](#) By Brian Winters



Let’s take a closer look at one of those solutions, the Hexagon Absolute Arm, its history, its performance in the field, and how it can help ensure parts meet specifications while reducing inspection bottlenecks. Before we delve into the history of the Hexagon Absolute Arm, let’s first explore exactly what an articulated arm is and how it has forever revolutionized the manufacturing industry.

In the past, performing measurements meant that an employee needed to bring the specific part to the static measuring machine — something that may be fine for a small widget but no easy feat for large, unwieldy or cumbersome parts. Not only did this waste motion and transportation, but it also created the opportunity for new damages or defects to occur.

Thankfully, about 50 years ago, inventor Homer Eaton had an idea — the ROMER arm, a bench-mounted articulating arm designed to measure tubes and pipes....

Eaton and his colleagues reimagined the arm as a portable device capable of capturing the geometry of all types of objects.

Hexagon acquired ROMER in 2004 and has since launched new models to meet measurement needs across industries, including aerospace and automotive. RA8, the company’s 8th generation ROMER Arm, features a modular architecture that allows it to carry a wide variety of sensors, including touch probes, laser scanners and tube probes.

Portable articulating measuring arms have been a game changer for manufacturers. “Having portable articulated measuring arms allow measurements to be made directly in the manufacturing environment, where process improvements are the most beneficial and most efficient,” said Brian Winters, North America Product Manager for Absolute Arms at Hexagon.

**Why manufacturers require ruggedness and portability** - Measurement doesn’t just take place in the factory; at times, it needs to occur in the field. That’s why manufacturers demand ruggedness and portability regarding their measurement tools. Hexagon’s Absolute Arm is made to be taken to the part for measurement, regardless of the environment. Lightweight and featuring hot-swappable batteries and wireless connectivity, the Absolute Arm is fully portable, performing equally well on forest or factory floors. Hexagon’s Absolute Arm can handle even the harshest environments. It is the only IP54-rated articulated arm in the world able to withstand splashes, dust and other solid and liquid particles.

**... Your measurements, your choice** - Your measurement devices can make your work more accurate, efficient, and of higher quality — or they can introduce their own set of problems. Choosing a portable Hexagon Absolute Arm for your measurement needs sets up your organization for convenient, accurate measurements in virtually any environment. – **Article continued on website**





**Don't miss The very first HANS Newsletter.** HANS is the new Human Body Model from DYNAmore. Sign up for up to date information.

DYNAmore GmbH [HANS Newsletter Issue #1](#)

Thank you very much for signing up to this newsletter and your interest in our human body model HANS. With this newsletter, we would like to inform you about the progress of our model development.

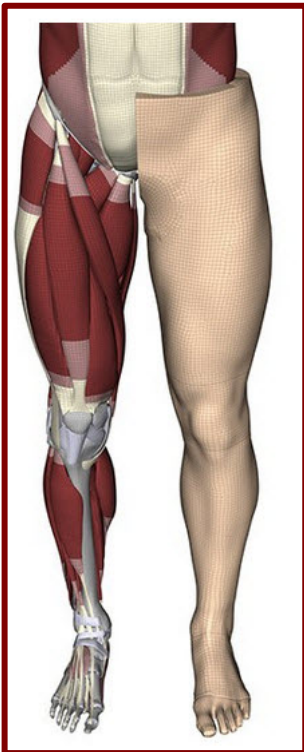
**Here are some key facts of HANS:**

- HANS is based on the scan data of an average male adult. Except for the heart and brain, the whole geometry has been derived from the same individual. The model's body dimensions are 176cm height at 79kg mass (BMI 25.5) and thus it matches the AM50 size
- the model aims for the next-level detailing and accuracy. In particular, we focus on the musculoskeletal system, including the bony structure and the muscle/tendon/ligament complex. We understand, accurate kinematics is key in human body simulation. Therefore, we decided to model each muscle individually. Consequently, HANS will already be prepared for 3D-active muscles which will be implemented at a later stage
- at this point, the overall model size will be less than 2 Mio nodes and elements and hence, comparable to the current detailed models in the market although many details are modeled with higher detailness
- we target to release a first version of the model in summer 2023

Currently we are in the heavy lifting of the model build. From the beginning, we have been running overload tests to identify and address potential robustness issues. Also, we started to calibrate different regions of the model to ensure and improve the model's biofidelity.

**The next steps are:**

- finish model assembly
- generate more test load cases
- continue with model calibration and initiate first validation simulations based on literature data



HANS is happy to answer your questions



Human Body Model HANS  
@ Human Body Model HANS

**All the best, Team HANS**

One more thing: Save the date! We are planning a free of charge Human Body Information Day on May 3rd, 2023 in Stuttgart, Germany and online.

Stay tuned!



Don't miss this interesting article

## Designing vibration damping with Ansys Mechanical by Dr.-Ing. Marold Moosrainer of CADFEM

Images: © CADFEM

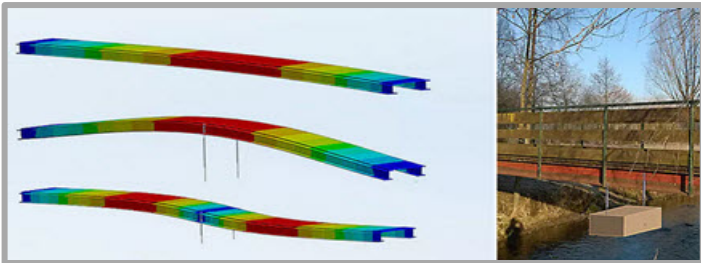


**Dr.-Ing. Marold Moosrainer**, “Did you know that the classical task of structural mechanics is to design stiffer or lighter structures for obvious reasons. Damping, on the other hand, is often perceived as something hardly tangible. It is little known how elegant damping of assemblies can be simulated and thus creatively designed to reduce vibrations. Right, we are talking about damping as a result quantity in the following.”

### CADFEM

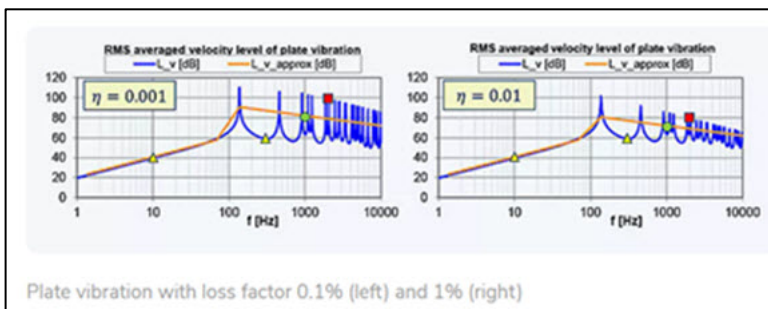
#### Excerpt [Designing vibration damping with Ansys Mechanical](#)

**What's the buzz with damping?** For dynamic analyses damping is crucial. This is what we have heard many times, but is this the complete truth?



Let's examine the behavior of a vibrating plate with two loss factors  $\eta$  differing by a factor of 10. Indeed, it is obvious that damping plays a dominant role in the resonances, where a factor of 10 in damping leads to a reduction of vibration amplitude by a factor 10, or in other words to a level decay of -20dB (red square). This holds for the specific case of a narrow-band excitation exactly in an eigenfrequency of the plate.

Taking a broad-band excitation and averaging the mean square velocity with respect to frequency as indicated by the straight line, we get a reduction of average vibration energy by a factor of 10, that is a reduction in velocity amplitude by a factor of  $\sqrt{10}$  and a level decay of -10dB, now (green circle). Again, damping plays an important role for the result amplitudes.



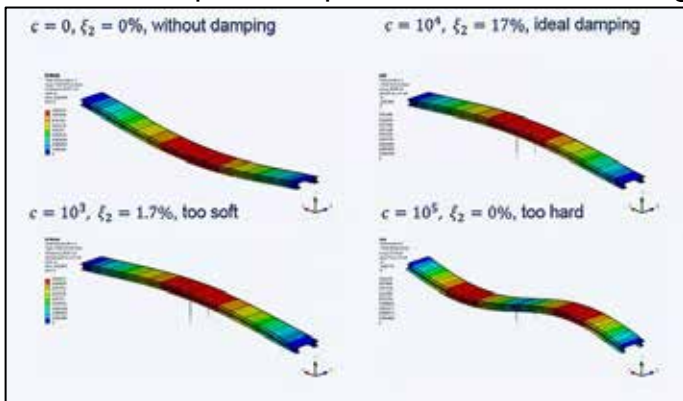
Finally, we observe frequencies, where damping has no effect on vibration amplitude at all (yellow triangles). This 0dB difference is clear for the quasi-static domain below the 1st eigenfrequency. But the same holds for the frequency regimes between resonances that are controlled by mass and stiffness and not by damping.

So damping is not decisive for vibration amplitudes in every case. Frequently it is much better to apply other vibration reduction approaches which we don't want to elaborate, here. But if damping is our favored method for a given vibration problem, we must have a design strategy and know how to model it in our Ansys Mechanical environment. And this is what we will discuss in the following.

**Article Designing vibration damping with Ansys Mechanical Author - Dr.-Ing. Marold Moosrainer**

**Can damping be computed as a result value?** Let's consider a slender pedestrian bridge where vibration amplitudes are too high when people walk across it. Say we want to reduce the most annoying vibration amplitude of the 2nd mode, that is the 1st vertical bending mode, by a pair of damping elements, and we are looking for the optimum damping coefficient  $c$ . A damped modal analysis does the job in Ansys Mechanical. The imaginary part of the resulting complex eigenvalues are the damped eigenfrequencies. Moreover, and even more interesting, the real part can be expressed in terms of a resulting modal damping ratio. The damping ratio  $\xi_2$  of mode 2 is an excellent measure for the damping or the decay of the vibration of the whole bridge assembly.

A damping coefficient  $c$  close to zero yields the same result of  $\xi_2 = 0$  as we have obtained with the undamped solver. Increasing damping drastically soon is too much of a good thing. Again, the reported damping ratio for mode 2 is  $\xi_2 = 0$ . Now we have figuratively spoken an almost rigid damper pot e.g., filled with very viscous bitumen resulting in sort of a fixed support for the center of the bridge. After some trials we obtain a value of  $c = 104 \text{ Ns/m}$  for the optimal damping coefficient. As a result, we get a maximum damping ratio of  $\xi_2 = 17\%$  for the assembly. Please note: 17% is huge because we get an amplitude drop of 90% after only 2 cycles. From this simple example, we draw the following conclusions:



Damped modal analysis for a bridge with discrete damping measures looking for the optimal damping constant

- Known damping of a distinct component can be “translated” in damping of the full assembly mode by mode, an exciting result for the design of damping measures.
- There is an optimum for each damping measure. The modal damping ratio, computed by means of damped modal analysis, is the suitable target variable, which virtually imposes itself for optimization.
- Once the optimum damping coefficient has been determined, the next step is to consider how it could be realized technically, for example by simply purchasing the appropriate damping device from catalogue or by designing with strongly damping high-polymer materials oneself rendering the simulation model more detailed.

Article [Designing vibration damping with Ansys Mechanical](#) continued on the website.

The following are discussed:

- How to enter damping in Ansys Mechanical?
- Closer to materials science – define loss factor
- What are typical damping values?
- How to tailor vibration reduction with damping material?
- What else is possible in Ansys Mechanical?

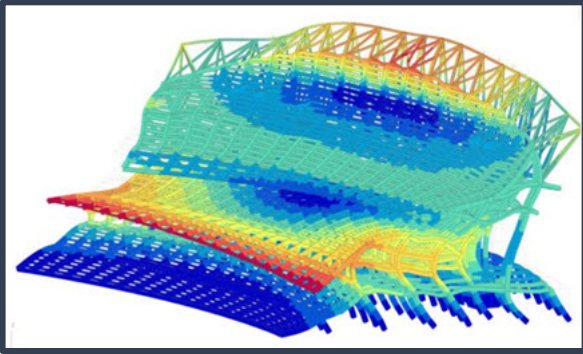




**Arenas and stadiums are often made from steel and are built with extremely large groups of people in mind and so have special requirements when calculating crowd excitation vibrations.**

Crowds at music concerts or watching sporting events often sing and dance along to their favourite artists or jump for joy as their team scores.

You can use OasysGSA to calculate all human induced vibration loadings using a variety of advanced analysis methods.



**Excerpt – Case Study - [Queens Wharf Redevelopment, Auckland - a double-storied cargo shed was repurposed as an events venue](#)**

The development project was completed and welcomes over 100 cruises and 200,000 visitors to Queen's Wharf, a public space for citizens and a gateway for visitors to Auckland, every year. Shed 10 and the Wharf are registered as a Category 1 Historic Place, which is the highest level of heritage status and protection.

**Project Overview** - As part of the Queens Wharf Redevelopment project, the Auckland Waterfront Development Agency worked with one of the largest professional services consultancies in the Asia Pacific, Beca, to redevelop Shed 10 among other waterfront structures. Once a double-storied cargo shed, Shed 10 was adapted for re-use in time for the Rugby World Cup and then underwent further refurbishment to become Auckland's primary cruise ship terminal and an events venue. This phase of the project posed two particular structural challenges that required accurate modelling of the vibration performance of the structure.

**Challenge 1: Stairs** - The first structural challenge that Beca faced during the project was the introduction of a new stair case that was to provide both primary access to the upper floor and also provide a key fire egress route. As a result, this called for a relatively wide stair (3m) to allow for the movement of a large volume of people. This was further complicated by a requirement for the stair to span 12 metres to a hanger system suspended from a new 12 metre span beam as no new columns were allowed on the wharf deck below. Due to the potential for large cumulative deflections of this combined system, steel truss stringers were required to be concealed in the solid clad balustrades.

**Challenge 2: Column Removal** - The second unique challenge of the project was the prior removal of a line of internal columns within Shed 10 that formed a very long beam span of 16 metres on the eastern side of level 1. As a result of the column removal, the floor would be significantly livelier on this side compared to the west....**See the website for additional information**

Oasys | LS-DYNA ENVIRONMENT ARUP

**SAVE THE DATE**  
**8 June 2023**

UK Oasys LS-DYNA Conference  
Birmingham, United Kingdom

Soon we will be opening the registration, so please stay tuned.

If you aren't subscribed to our newsletter yet, please do, as this is how we will be communicating with you.

[Sign Up For Information on our Conference](#)





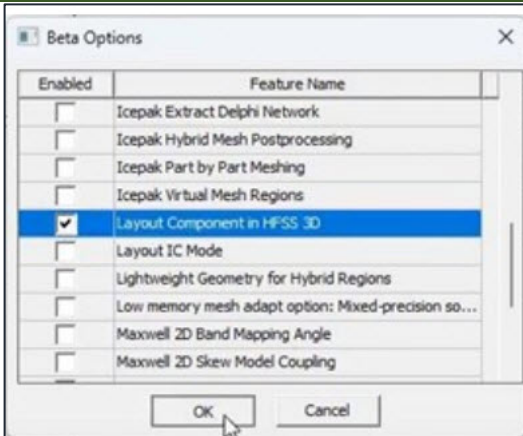
**February Blog by A. Benleulm,** “Good news! It is now possible to import HFSS 3D Layout designs as components into HFSS 3D environment. This means that a complex layout component can interact with surrounding 3D geometries without the need to use a 3D geometry exported from HFSS 3D Layout. Although this feature works very well, it is treated as Beta in the newest Ansys release “23R1”.

### Excerpt Paragraphs from - [Layout Component in HFSS 3D](#) Blog posted by: Adel Benleulmi

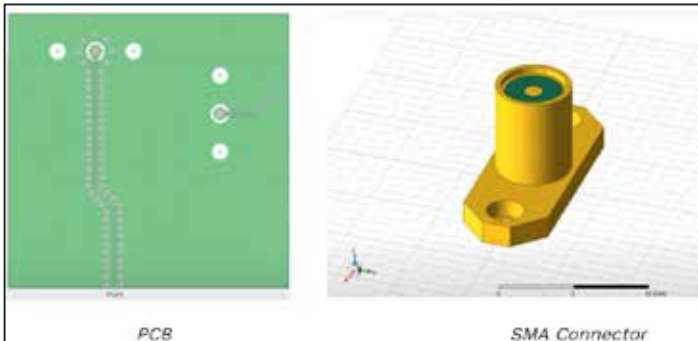
Here, I will be showing you through an example how to use this feature which allows great scalability in having a complex layout geometry within an EMI/EMC 3D environment. Let's get started!

**Overview** - Since the “Layout Component in HFSS 3D” is a Beta feature, it is important to make sure that it is enabled in the Beta Options window before starting.

[You can watch all the steps described here in detail on our video on YouTube](#)



*Beta Options*

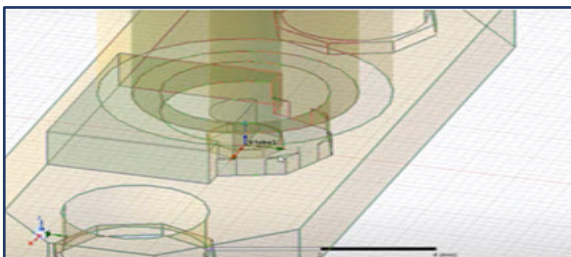


PCB

SMA Connector



Created CS



Now, let's consider this example where we have a printed circuit board (PCB) and we want to place some SMA connectors on it. Here, the PCB is an HFSS 3D layout design and the SMA connector is a 3D geometry in HFSS 3D.

Before exporting the PCB design as a layout component, we will create two coordinate systems (CS) to help place the SMA connectors.

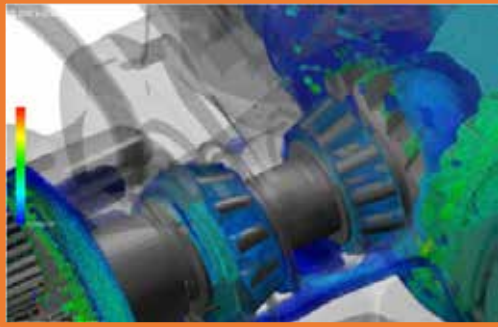
The SMA connector also has a global CS located at the bottom of the pin.

When importing the layout component and SMA connectors, the CS of the layout component will be used as reference for the SMA connectors. In fact, since the original layout design includes additional CS, these are included as properties to the layout component in HFSS 3D.

When importing the SMA connectors, the reference CS of the latter will snap to the target CS we choose. This significantly simplifies placement in HFSS.



EnginSoft wishes to acknowledge “Il Progettista Industriale” which first published this article in its magazine in April 2021. **Comer Industries, based in Reggio in the province of Reggio Emilia, is the leading global player in the design and production of advanced engineering systems and mechatronics solutions for power transmission.** The company operates in the fields of agricultural machinery, construction and forestry equipment, energy and industry.



**Excerpt - Lubrication and heat dissipation in transmissions and bearings are critical to both the performance and the life of these systems.**

**ABSTRACT** - Transmission design is mainly based on the mechanical aspects of the transmission and lubrication is an aspect that is verified, and eventually corrected, based on bench testing, i.e. once the design phase has been completed and a physical prototype is available.

The use of transparent prototypes or windows in specific regions of the transmission makes it possible to visualize, at least partially, the flows and distribution of the lubricant within the transmission, and to understand whether it reaches the various components.

Similarly, by means of a physical prototype and bench tests, it is possible to verify the correct positioning of the breather ducts, which must be adequately protected in order to prevent the escape of the lubricant, and the functioning of the transmission under different operating conditions, for example by changing inclination, number of revolutions, or direction of rotation.

These are some of the issues faced daily by those who design and build transmissions of all kinds, from the automotive and industrial sectors to the aeronautical sector; from small transmissions to those for the naval and wind-power sectors.

However, waiting for an advanced stage of the project (i.e. once you have a prototype on the bench) to address the issue of lubrication can present surprises that can significantly impact both the development time of the transmission and its cost.

Discovering that some vital components, such as bearings, are not properly lubricated, or that there are oil leaks from the vents may require design changes, which can be costly at this late stage. In addition, there are some machine operating conditions that cannot be or are difficult to test on the bench, such as dynamic braking, acceleration, or particular temperature conditions.

To address these issues and to reduce the risks, costs and development times of transmissions, more and more companies are shifting the issue of “good lubrication” from the experimental verification phase to the actual design phase.

This has come about thanks to the availability of new numerical simulation technologies that enable the use of a virtual bench to test different operating and lubrication conditions quickly, and especially before building a physical prototype.

Models of this type complement and complete experimentation and, if used in the preliminary stages of the design, allow the project to be directed correctly and prevent lubrication or overheating problems.

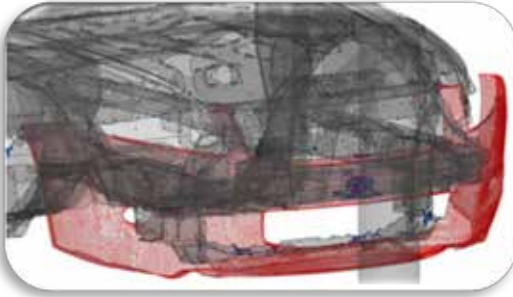
**Please continue to read the article on the EnginSoft Expertise Website**



## Short Fiber Reinforced Plastics

Case study: Verify the strength of thermoplastics components with LS-DYNA and Moldex3D

All videos can be viewed on the website



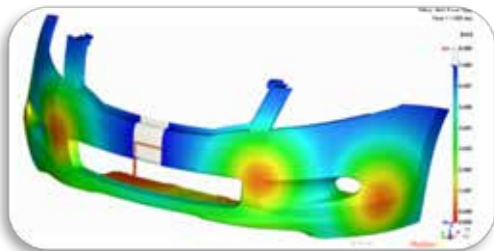
**DYNAmore Nordic - Strength evaluation before manufacturing - is that possible?** Short fiber reinforced thermoplastics have been used since the middle of the last century, but calculating these parts' structural strength has been a challenge. It turns out that to get accurate predictions of the material strengths, one needs to account for the fiber orientations.

The orientations will, in turn, depend on the injection molding process. To solve this problem, DYNAmore offers a complete simulation software solution to verify the strength of the final component before manufacturing any tooling.

**Why numerical simulations?** Our primary software tool LS-DYNA has always been committed to representing the actual physics of structural problems to an increasingly higher level of detail. Even though advances in numerical solution techniques makes it technically possible to do this, why should one bother? Well, the reasons for performing simulations for your products are several. Some of the most common reasons we encounter in our daily work with customers are

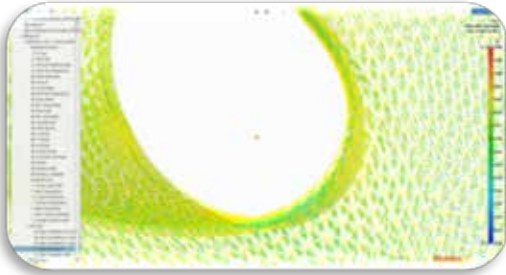
- understanding poor (or good) product performance
- establishing which parameters that are important to control in your process, i.e., that influence the product performance
- a virtual copy (or a digital twin if you like) of your process and product, facilitates studies of changes and improvements to the product, without potentially costly experimental studies, including manufacturing of new tools or molds
- optimization of product performance is made possible

**Our technical solution – Case study: polymer bumper front** Here we demonstrate our solution for a bumper front. There are several strength requirements on the bumper front, but we will look at an impact test. The bumper front is a large fiber-reinforced component, which requires big and expensive tooling.

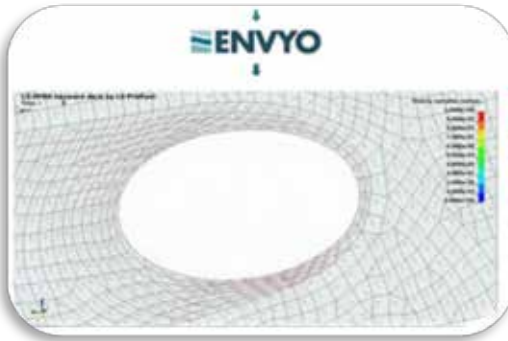


**Step 1: Injection molding simulation of the bumper in Moldex3D** - To assess the orientation of the fibers in the final product, start by performing an injection molding simulation in Moldex3D. It is a powerful tool and yet easy to use, considered a market leader for plastics molding simulation and fiber orientation prediction in injection molded parts [1].





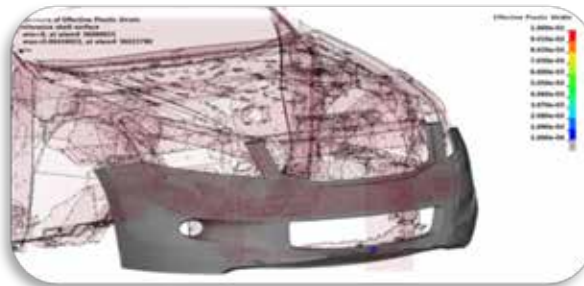
**Step 2: Utilising the injection molding simulation results** - Several alternative ways to make use of the fiber orientations in the subsequent LS-DYNA model exist. Based on our experience, we have two preferred ways of working. One way is to work with Digimat, an add-on material modeling software from e-Xstream. You can couple Digimat to LS-DYNA in simulations, and all the files needed by Digimat can be output directly from Moldex3D.



Another option is to use the mapping software Envoyo® from DYNAmore. Fiber orientations, including possible weld lines from the injection molding process, can be mapped to existing shell or solid meshes in your LS-DYNA model.

You can also perform homogenization of material properties when applicable.

For the following structural analyses, we recommend the LS-DYNA material models that support anisotropic elastic and plastic behavior due to the fiber orientations, e.g., MAT\_OPTIONTROPIC\_ELASTIC, \*MAT\_ANISOTROPIC\_ELASTIC\_PLASTIC, and \*MAT\_4A\_MICROMECH. If you are already using another software than Moldex3D for the injection molding simulations, Envoyo also has interfaces to other software.



**Step 3: Using LS-DYNA to check the bumper performance for the impact load** - After mapping the fiber orientation from the Moldex3D analysis using Envoyo or Digimat, the LS-DYNA vehicle model now includes a bumper containing mapped fiber directions. The pole impact simulation is performed as usual, illustrated in the figure below, and the verification of the bumper's performance can take place.

**To learn more** - Simulations have time and again proven to be a cost-effective product development tool that avoids costly tooling redesign. We have the software and knowledge required so that you may learn to perform these simulations yourself. We will guide you all the way, including training and support. [To learn more, please contact one of our technical experts listed on this page.](#)

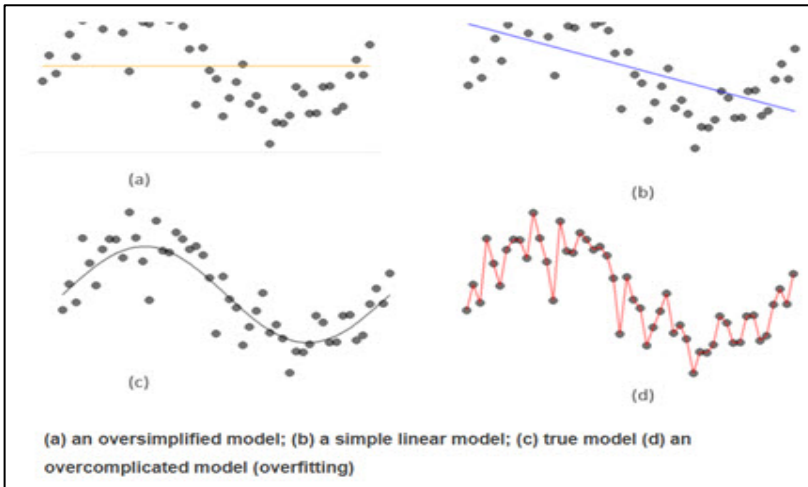
[1] Kunc, V., Warren, D., Yocum, A., Wu, F., 2017, "IV.3 Predictive Engineering Tools for Injection-Molded Long Carbon Fiber Thermoplastic Composites – Oak Ridge National Laboratory", LIGHTWEIGHT MATERIALS FY 2016 ANNUAL REPORT, U.S. Department of Energy, Troy, Michigan, September, 2017, pp. 125-141. - The car used in this demonstration is a modified version of the publicly available Honda Accord model, provided by NHTSA, <https://www.nhtsa.gov/crash-simulation-vehicle-models>.





## Did you know that Bing published a new blog on Choose Machine Learning Models with Cross Validation

And don't miss his blog **Introduction and Application of d3VIEW-ML** explaining that machine learning is a data analysis technique that builds a model with the data and uses the model to predict. It learns from the data, identifies patterns and produces reliable predictions that help with decision making.



### d3VIEW - Blogs

[Choose Machine Learning Models with Cross Validation](#)

[Application of d3VIEW-ML](#)

Machine learning techniques are becoming unprecedentedly popular. And it plays an important role in data analysis. It is critical to find the model that demonstrates the best performance. Intuitively, we can build a few different models with the data given and see which model gives the best score, either it being RMSE (root mean squared error), R squared for regression models or accuracy, precision for classification models.

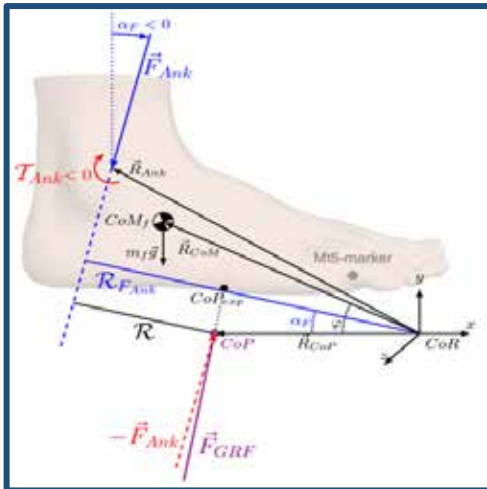
**Overfitting** - You may have already sensed the problem with this approach. A more complicated model is always going to perform better. An extreme example is we can just connect all data points with lines or equivalently assign y values to each x values as they are in the given data. The error will be zero. However, when this complex model is applied to some new data, it will produce more errors. This is called overfitting. It happens because data contain noises or random errors. For example, when we are measuring a person's height multiple times, we may have different readings each time due to factors such as the angle of our eyes to the reading, or the light in the environment or simply we want to quickly finish the work and move forward. Though the person's height remains unchanged, the readings we have are different. These noises generate uncertainty in the target y values. Therefore, a good model should keep this uncertainty in its consideration.

Continued on the website with graphs

- **Cross validation**
- **Cross validation on d3VIEW Workflow**



**Syn Schmitt Professor at University of Stuttgart** - Do you want to know, how the foot supports and enables human walking? Then read this important paper! Well done Daniel, Susi and Michael.



### Foot function enabled by human walking dynamics

**Daniel Renjewski**, Chair of Applied Mechanics, Department of Mechanical Engineering, School of Engineering and Design, TU Munich, 85748 Garching, Germany

**Susanne Lipfert**, Section for Applied Sport Science, Dept. of Sport and Health Sciences, TU Munich, 80809 München, Germany

**Michael Günther**, Computational Biophysics and Biorobotics Group, Institute for Modelling and Simulation of Biomechanical Systems, University of Stuttgart, 70569 Stuttgart, Germany

Figure A schematic of the foot model with all dynamic actors.

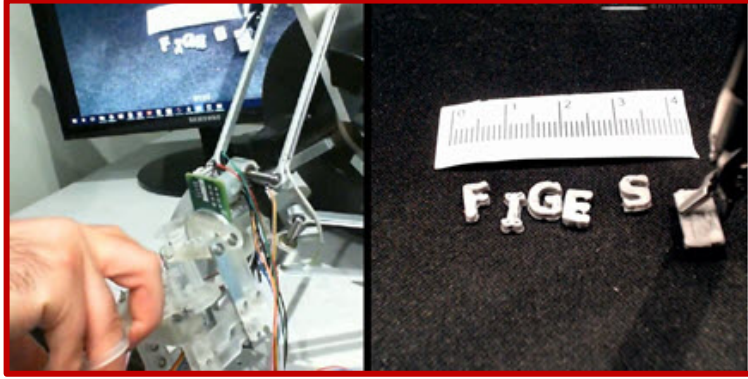
### Abstract

Bipedal walking, the habitual gait for man, is rather unique in nature and poses particular challenges for balance and propulsion. The characteristic double-humped ground reaction force profile has been widely observed but not put into functional context. We propose a mathematical model that captures the dynamics of the human foot in walking including the characteristic motion of the center of pressure. Using this model, we analyze the functional interplay of all essential biomechanical contributors to foot dynamics in walking.

Our results demonstrate the intricate interplay of a self-stabilizing mechanism which allows extending a leg's stance phase while simultaneously powering rapid swing by condensing the essentials of foot dynamics into a reductionist, biomechanical model. A theory is presented which identifies the foot to be the key functional element and which explains the global dynamics of human walking. The provided insights will impact gait therapy and rehabilitation, the development of assistive devices, such as leg prostheses and exoskeletons, and provide guidelines for the design and control of versatile humanoid robots



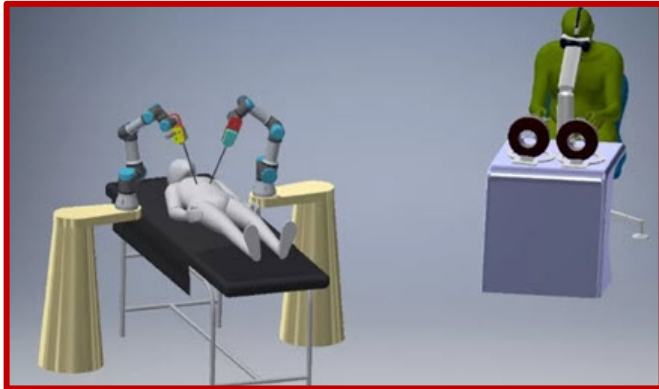
It is widely agreed that an important short-coming of the currently available surgical robotic arms is the inability to transmit the sense of force to the master console. With the Master Robot, which provides force and pressure feedback, developed under this project, a critical technology that can be implemented in the new generation surgical robots has now been developed with national resources



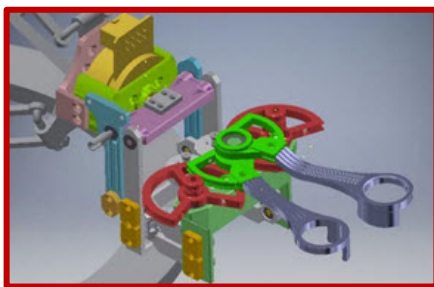
#### FIGES AS - [Surgical Robotic Arm](#)

**Abstract** - It is widely agreed that an important short-coming of the currently available surgical robotic arms is the inability to transmit the sense of force to the master console. With the Master Robot, which provides force and pressure feedback, developed under this project, a critical technology that can be implemented in the new generation surgical robots has now been developed with national resources.

This system consists of a Master Robot, a Slave Robot – which is compatible with the Da Vinci Endowrist surgery apparatus – and an integrated sensor actuator module.



The Master Robot (see Figure 2, Figure 3), which has been developed within the scope of this project, offers 7 degrees of freedom and is capable of providing feedback for the forces with 4 degrees of freedom. Additionally, it provides a pressure feedback in the same manner that can be felt by a surgeon's index finger. The working space of the Master Robot has been designed to prevent uncomfortable feeling during longer operations by taking the surgical ergonomics into account.



Moreover, within the scope of the project, a module was designed with 4 DC engine power that can move the Slave Robot – the surgery apparatus (Da Vinci Endowrist) – pertaining to the Da Vinci surgical robot (see Figure 4, Figure 5).

A precise torque sensor (see Figure 7) was designed and manufactured within the scope of the project to detect the forces emerging from the 4th, 5th, 6th, and 7th degrees of movement of Da Vinci Endowrist (see Figure 6) during the surgery. This sensor provides measurement range up to 1.3 Nm and 0.071 Nmm precision.

**Article continued on the FIGES website**



KAIZENAT (LUPA) License Utilization & Predictive Analytics is a scalable, customizable, dynamic platform for Software Asset Optimization. LUPA helps organizations to optimize their software assets and thereby reduce costs. Additionally, it supports assets across various geographies and across various network.

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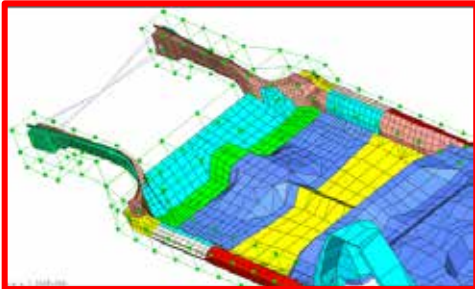
- Data Mining and Predictive Analytics
- Rich Visualization of various asset usage statistics
- Custom made reports to take quick and agile business decisions
- Hardware Asset Management & IT resource allocations

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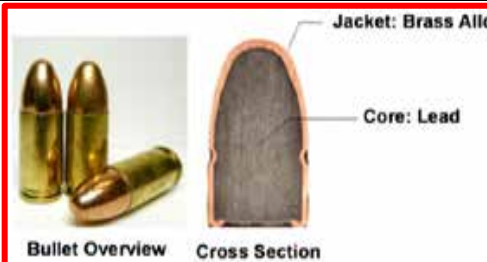
Email: [info@kaizenat.com](mailto:info@kaizenat.com)



Applus+ IDIADA - [is a Notified Body for the certification of Personal Protective Equipment](#) (PPE) that assists manufacturers in issuing the CE marking required for the commercialization of PPE in the EU.



OmniQuest - [the new version of Design Studio, v23](#), a new way of creating domains automatically for shape optimization called Quick Domains has been introduced. Shape optimization takes an existing structure and pushes its shape of it into the most efficient solution for your objectives and constraints.



Ameen Topa - [Finite Element Analysis on ballistic impact performance of multi-layered bulletproof vest impacted by 9mm bullet](#). My first contribution in 2023! It was a research collaboration with President University, Indonesia, in which we investigated the ballistic impact performance of a Kevlar composite target using finite element analysis. It is an openaccess article



Instar Engineering - [Engineering and Consulting Courses](#)

Instar's courses stem from a common philosophy: The way to reduce the cost of space programs is to improve engineering, management, processes, communication, and morale, and to do things right the first time. Among the courses are: Space Mission Structures: From Concept to Launch - Structural Design & Analysis for Aerospace Engineers - - Vibration Testing of Small Satellites - Ten Principles for Successful Space Programs



Welcome to our Town hall & Coffee Cafe. Coffee, of course vanilla, hazelnut, and other flavors are courtesy of our favorite coffee shop (not the rival coffee shop).



Today we visited the booths listed below on YouTube:

Free Coffee for visiting

[HEXAGON](#)

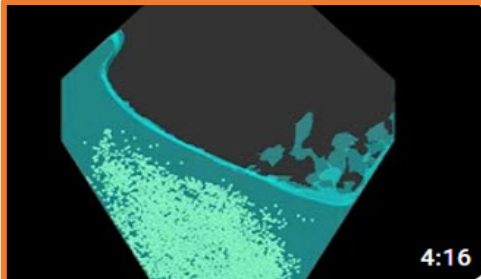


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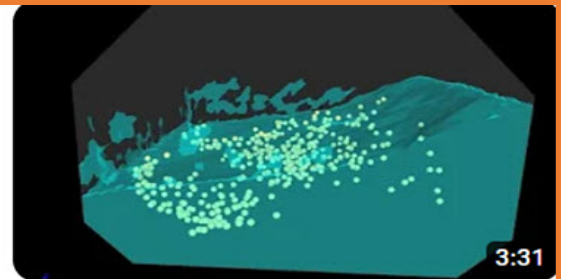


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[Lancemore JP](#)



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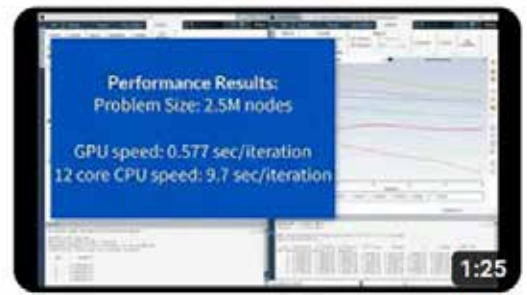


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[OZEN Engineering](#)

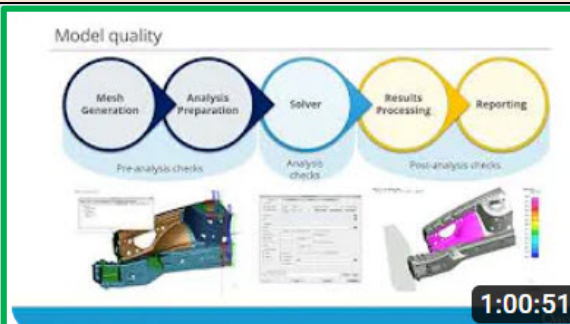


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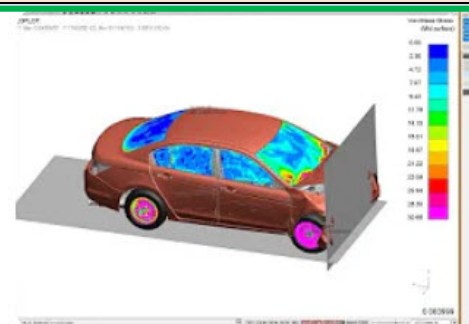


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[OASYS](#)



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**No one knows his name. You yell, "HEY, old racer."**

**After four years in development, the first hydrogen-operated BMW iX5 Hydrogen models are hitting the roads. This vehicle and development project is entering an important phase: practical operation.**



**EXCERPTS - [Launch of the BMW iX5 Hydrogen pilot fleet.](#)**

. The wait is over: the first BMW iX5 Hydrogen vehicles are now on the roads. In the course of the year, the pilot fleet will be used worldwide by various target groups for trial and demonstration purposes.

This will give the development team valuable practical knowledge about the vehicle and the everyday use of pioneering, hydrogen fuel cell technology.

The hydrogen fuel cell system developed and produced by BMW is further evidence of the leading development expertise the BMW Group has in the area of electric drive technologies. The BMW Group is systematically advancing the development of hydrogen fuel cell technology as a future option for the locally emissions-free individual mobility of the future.

**BMW Group accelerates the transformation of the mobility sector.** Oliver Zipse, Chairman of the Board of Management of BMW AG, has also emphasised the extraordinary importance of this innovative drive system: "Hydrogen is a versatile energy source that has a key role to play in the energy transition process and therefore in climate protection. After all, it is one of the most efficient ways of storing and transporting renewable energies. We should use this potential to also accelerate the transformation of the mobility sector."

To unlock this potential of hydrogen to the best possible effect, the BMW Group is producing highly efficient fuel cell systems at its own Munich-based centre of excellence for hydrogen. This technology is one of the most important components in the BMW iX5 Hydrogen and will sustainably influence the transformation of the entire mobility sector – and enhance it: "Hydrogen is the missing piece in the jigsaw when it comes to emission-free mobility. One technology on its own will not be enough to enable climate-neutral mobility worldwide," comments Oliver Zipse.

**Fuel cell systems: fascinating and highly efficient at the same time.** The BMW Group is an absolute pioneer in the area of hydrogen fuel cell technology, and is advancing this exciting development on an ongoing basis. In this process, a chemical reaction takes place in the fuel cell between the gaseous hydrogen from the tanks and the oxygen from the ambient air. A uniform supply of these two media to the membrane in the fuel cell is crucial for high drive efficiency.

The BMW Group has developed special hydrogen components for the new fuel cell system to complement technological analogies to the combustion engine such as the intercooler, air filter, control units and sensor technology. These include for example a high-revving compressor with turbine or a high-voltage coolant pump. There are two stages in fuel cell production: first, the individual fuel cells are piled up to create a fuel cell stack. Then, all the other components are fitted to form a complete fuel cell system. **Continue on Site**



**Lockheed Martin announced the successful first flight of the F-16 Block 70 at its Greenville, South Carolina site.**

The flight occurred Jan. 24 at 9:17 a.m. ET, with Lockheed Martin test pilots Dwayne "Pro" Opella and Monessa "Siren" Balzhiser at the helm. Total flight time was approximately 50 minutes and included airworthiness checks, such as engine, flight control and fuel system checks, as well as basic aircraft handling.

"Today's successful flight is a testament of the hard work, dedication and commitment to our customers and their missions," said OJ Sanchez, vice president, Integrated Fighter Group, which includes the F-16 program. "This milestone demonstrates Lockheed Martin's commitment to advancing this program and getting this much-needed aircraft and its advanced 21st Century Security capabilities to the warfighter."

This F-16 Block 70 jet is the first of 16 jets to be delivered to Bahrain. Six countries have selected Block 70/72 aircraft. In addition to the current official backlog of 128 jets to-date to be built in Greenville, Jordan last year signed a Letter of Offer and Acceptance (LOA) for eight jets and last week signed an additional LOA for four more jets. Lockheed Martin has received a contract to begin Jordan's long-lead activities. Bulgaria has also signed an LOA for an additional eight jets for its fleet. Once these are finalized, the backlog will increase to 148.

"Lockheed Martin is fully committed to delivering quality platforms for our customers' critical missions, and I am so proud of our talented team in Greenville," said Danya Trent, F-16 Vice President and Site Lead in Greenville. "This is the culmination of significant development, design, digital engineering, supply chain and production line advances to an already proven platform that will continue to deliver decades of service in support of customers' national security."

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### EXCERPT

Bayraktar Akıncı and Bayraktar TB2 unmanned combat aerial vehicles (UCAVs) developed by Turkish drone magnate Baykar are aiding earthquake relief efforts in Türkiye's south.

In the aftermath of the 7.7 and 7.6 magnitude earthquakes that struck 10 provinces, with the epicenter in the Pazarcık and Elbistan districts of Kahramanmaraş province, the Bayraktar Akıncı UCAVs took off from Şanlıurfa and Batman for nonstop mission flights, the Presidency of Defense Industries (SSB) informed.

These missions included detection, search and rescue support, and coordination activities in adverse weather conditions.

On the first day of the earthquake, conventional planes and helicopters were unable to fly due to adverse weather, storms, snowfall and cloud cover.

However, Bayraktar Akıncı UCAVs, being unmanned, were able to undertake flights in unfavorable conditions. The images captured by the Bayraktar Akıncı's camera provided valuable insight into the meteorological aspects of the disaster. Despite the challenging weather conditions, the Bayraktar Akıncı UCAVs flew for hours, searching for even the most minute detail to evaluate the situation.

The number of Bayraktar Akıncı and Bayraktar TB2 flight missions has been ramped up in the days following the earthquakes and currently, a total of nine Akıncı and 22 TB2s are operating in the region.

The drones have been instrumental in providing continuous updates and data to the crisis response team for damage detection, search and rescue support, along with coordination activities.

In addition, three Bayraktar TB2 UAVs equipped with the Baykar Rapid Mapping Pod have started capturing high-resolution aerial images for damage assessment in the affected areas.

Meanwhile, Baykar has been providing both financial support and humanitarian aid from the first day of the catastrophic quakes.

The amount of cash that the company donated to the region within a period of four days reached TL 655 million (\$ 34.77 million), apart from their humanitarian aid support.

The company has also initiated a campaign to donate blood for earthquake victims, which saw some 642 employees participating so far. "We will continue to donate blood tomorrow," it said in a statement on Friday.





[Courtesy of and Copyright to USAF Photo](#)

## US Airforce Week in Pictures



### Wheels down

A C-130 Hercules from the Savannah Air National Guard prepares to land at Joint Base Charleston, S.C., Feb. 16, 2023, while transporting participants for Accelerating the Legacy 2023. Accelerating the Legacy is an aviation heritage event that honors the Tuskegee Airmen's legacy, offers professional development and networking opportunities to Total Force Airmen, and inspires the next generation of aviation professionals.

(U.S. Air Force photo by Tech. Sgt. Alex Fox Echols III)



### Falcon on patrol

A U.S. Air Force F-16 Fighting Falcon assigned to the 77th Expeditionary Fighter Squadron, flies a combat patrol mission within the U.S. Central Command area of responsibility, Feb. 13, 2023. The fighter aircraft routinely conduct patrols within the CENTCOM AOR to provide combat airpower and ensure regional security and stability.

(U.S. Air Force photo by Tech. Sgt. Daniel Asselta)



### Soaring Eagle

A U.S. Air Force F-15E Strike Eagle assigned to the 389th Expeditionary Fighter Squadron flies within the U.S. Central Command area of responsibility Feb. 5, 2023. The 389th EFS's mission is to deliver dominant combat airpower and fortify the U.S. commitment to deterrence and regional stability.

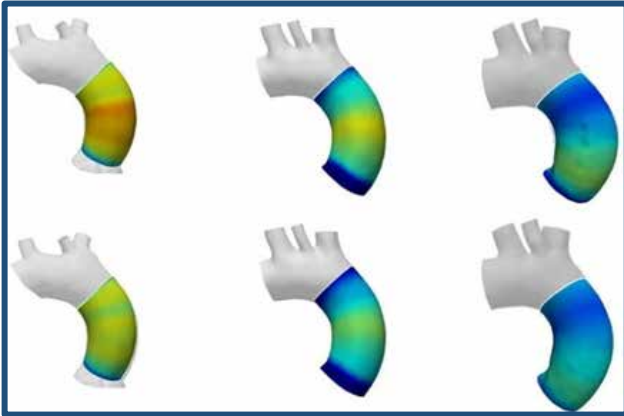
(U.S. Air Force photo by Tech. Sgt. Daniel Asselta)



**Marco Evangelos Biancolini**

RBF Morph CTO & Founder - Associate Professor of Machine Design

**A new paper "An image-based approach for the estimation of arterial local stiffness in vivo" has been published in the Frontiers in Bioengineering and Biotechnology journal in collaboration with the MeDiTATe-project**



### [An image-based approach for the estimation of arterial local stiffness in vivo](#)

The paper was written by Simona Celi, Emanuele Gasparotti, Katia Capellini and Emanuele Vignali from BioCardioLab (Fondazione Toscana G. Monasterio), Francesco Bardi (ESR 10), Martino Andrea Scarpolini (ESR 09), Carlo Cavaliere (IRCCS SynLab SDN) e Filippo Cademartiri (Dipartimento Immagini, Fondazione Toscana Gabriele Monasterio).

**Abstract** - The analysis of mechanobiology of arterial tissues remains an important topic of research for cardiovascular pathologies evaluation. In the current state of the art, the gold standard to characterize the tissue mechanical behavior is represented by experimental tests, requiring the harvesting of ex-vivo specimens.

In recent years though, image-based techniques for the in vivo estimation of arterial tissue stiffness were presented. The aim of this study is to define a new approach to provide local distribution of arterial stiffness, estimated as the linearized Young's Modulus, based on the knowledge of in vivo patient-specific imaging data. In particular, the strain and stress are estimated with sectional contour length ratios and a Laplace hypothesis/inverse engineering approach, respectively, and then used to calculate the Young's Modulus. After describing the method, this was validated by using a set of Finite Element simulations as input. In particular, idealized cylinder and elbow shapes plus a single patient-specific geometry were simulated. Different stiffness distributions were tested for the simulated patient-specific case. After the validation from Finite Element data, the method was then applied to patient-specific ECG-gated Computed Tomography data by also introducing a mesh morphing approach to map the aortic surface along the cardiac phases. The validation process revealed satisfactory results. In the simulated patient-specific case, root mean square percentage errors below 10% for the homogeneous distribution and below 20% for proximal/distal distribution of stiffness. The method was then successfully used on the three ECG-gated patient-specific cases. The resulting distributions of stiffness exhibited significant heterogeneity, nevertheless the resulting Young's moduli were always contained within the 1–3 MPa range, which is in line with literature.

Thanks to a post on social media by Syn Schmitt, Professor at University of Stuttgart

For people who cannot move their hands or legs due to, for example, a spinal cord injury, a stroke or other diseases, so-called brain-computer interfaces (BCIs) offer great hope: They allow a device to be controlled by brain activity alone — for example, an exoskeleton can be operated solely by imagining a motion. Thus, BCIs offer paralyzed people the chance to regain control over some of their movement.



### Controlling neural exoskeletons more precisely with diamond sensors (EXCERPT)

Quantum technology of the University of Stuttgart involved in BMBF lighthouse project "NeuroQ"

Brain-computer interfaces are able to restore some mobility to paralyzed people by controlling exoskeletons. However, more complex control signals cannot yet be read from the head surface because conventional sensors are not sensitive enough...

Photo: AG Klinische Neurotechnologie, Charité – Universitätsmedizin Berlin

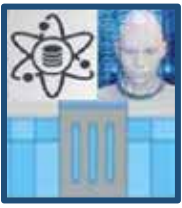
Lighthouse project, the project partners develop highly sensitive diamond-based quantum sensors that will enable paralyzed people to control neural exoskeletons more precisely.

BCIs, which measure brain activity from the surface of the head, have the advantage of sparing patients a complicated and risky brain surgery. "We have already developed a non-invasive BCI system that enables people with high paraplegia to grasp everyday objects by means of arbitrary changes in their brain waves," reports Prof. Dr. Surjo Soekadar, Professor for Clinical Neurotechnology at the Charité, adding: "However, despite the considerable progress made, it has not yet been possible to control complex hand movements with such a non-invasive system." Thus, although the intention to move can be detected, it is not possible to determine exactly which movement is to be executed. To achieve this, the sensitivity of the sensors would have to be increased considerably.

**Quantum sensors measure brain waves** - Nine partners from research and industry have now taken on this task and launched the project "Laser Threshold Magnetometer for Neural Communication Interfaces", or NeuroQ for short. In this project, which is funded by the German Federal Ministry of Education and Research (BMBF), the project partners develop quantum sensors that are so sensitive that they can measure the smallest magnetic fields generated by brain waves. These quantum magnetometers will be integrated into a BCI system, enabling paralyzed people to control a hand exoskeleton much more precisely than it is currently the case.

Magnetic fields provide more distinct signals - In non-invasive BCIs, the measurement of neuronal activity has so far mainly been performed via electric fields. However, the measurement of magnetic fields offers considerable advantages: "Magnetic fields penetrate the skin and skull undistorted and thus provide much more distinct signals than electric fields, since these are strongly attenuated on the way from the source to the sensor. Hence, magnetoencephalography (MEG) has significant advantages over electroencephalography (EEG), but is rarely used due to technical obstacles," explains Dr. Jan Jeske, project leader of NeuroQ and researcher at Fraunhofer IAF...





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**Eduardo V.S. Ramirez, freelance marketing**

This month I'd like to have an article on Machine Learning. If you would like to be showcased in our building, please write to [feaanswer@aol.com](mailto:feaanswer@aol.com) with your software URL

First let's answer a few questions in regard to what machine learning encompasses and what are our goals for this technology. This month I will be showcasing machine learning with d3VIEW?

### **What exactly is Machine Learning?**

Machine learning is actually a subset of artificial intelligence (AI). Machine learning involves training computer algorithms to learn from and to make predictions or decisions based on data. It accomplishes this without being explicitly programmed to perform specific tasks. It involves creating models that can learn from data and make predictions or decisions on new, unseen data.

The machine learning algorithms are trained using large datasets, which allows them to identify patterns, relationships, and trends in the data.

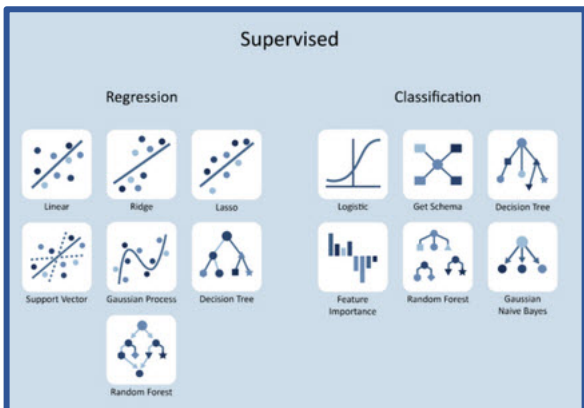
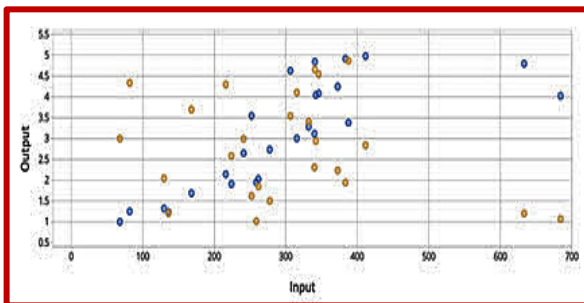
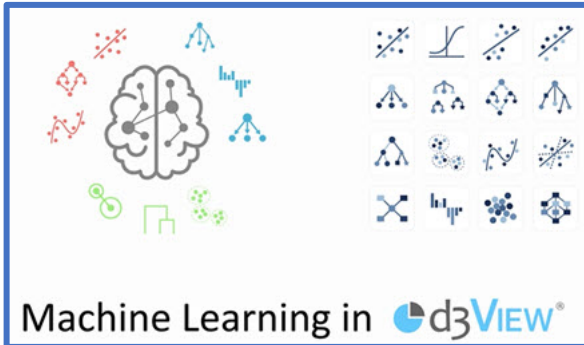
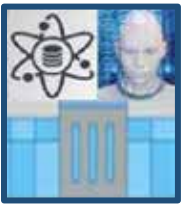
### **What is our goal?**

Our goal for machine learning is to enable computers, as they are exposed to more data, to automatically improve their performance on a given task. The more data that is provided the more they can perform the task.

### **What are the types of the machine learning algorithms?**

There are several types of machine learning algorithms:

- supervised learning, the algorithm is trained on labeled data, where the desired output is known for each input.
- unsupervised learning, the algorithm is trained on unlabeled data, where the desired output is unknown
- reinforcement learning, the algorithm learns through trial and error, by receiving feedback from the environment based on its actions.



Excerpts: For the graphics and videos please visit:

[d3VIEW - Machine Learning - Learn and Predict Data to Make Better and Faster Decisions](#)

Data Exploration is looking into advanced extraction, organization and visualizers that play a major role in discovering the insights in our data to reveal the patterns and relational variables.

**d3VIEW has 16 machine learning models**, at this time, to utilize and in the near future more will be added.

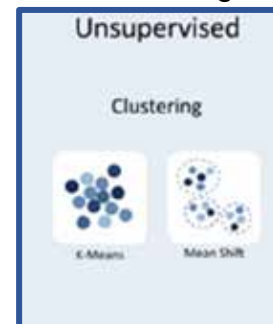
**You can choose from supervised or unsupervised learning types.**

**The supervised has two learning types:**

- regression which predicts numerical values.
- classification which predicts categorical values.

**The unsupervised learning type:**

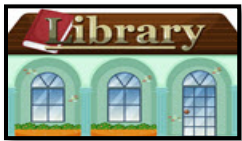
- clustering, which groups data points into clusters for a more generalized understanding of patterns in data.



**Categories with examples on the website:**

- Predicting Head Injury Criteria from Pedestrian Impact Simulations
- Using Prediction Models
- Predicting Iris Flower Species
- Predicting Groups for Auto MPG and Weight
- ML App Integration - Currently, the main d3VIEW applications that can tap into these Machine Learning capabilities include HPC jobs, Simulations, Physical Tests, Databases, Workflows and Simlytiks®.





[For the brochure please download the pdf](#)

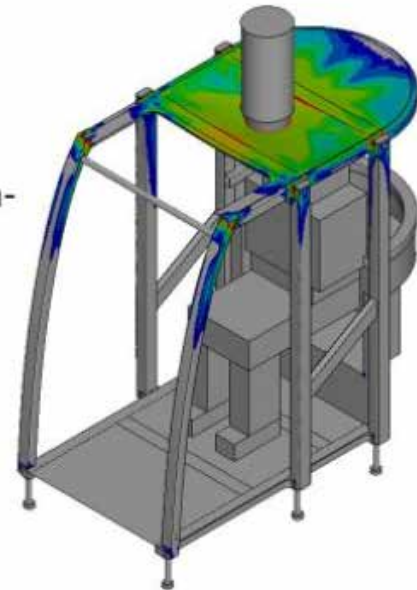


DYNAMORE Reference Desk

## Webinar Quiz!

Falling object protective structures (FOPS) for earth-moving machinery are said to be either level 1 or level 2, but what is the difference between them?





-  All FOPS start at level 1, but as they gain experience protecting against falling objects, they reach level 2.
-  For multi-storied testing facilities, it indicates whether the FOPS was tested on the first or second floor.
-  Level 1 protects against a 100 kg falling object, and level 2 protects against a 200 kg falling object.
-  Level 1 offers impact protection against "small objects" (1365 J), and level 2 against "heavy objects" (11 600 J).

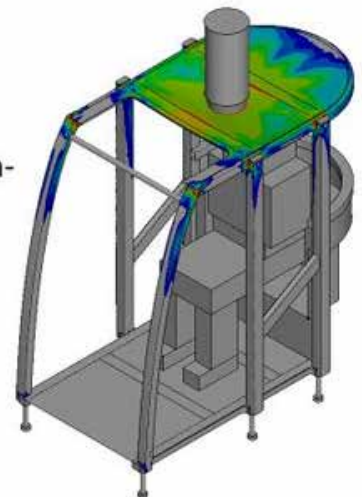


**DYNA**  
MORE

## Webinar Quiz – Answer!

Falling object protective structures (FOPS) for earth-moving machinery are said to be either level 1 or level 2, but what is the difference between them?

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**DYNA**  
MORE





The Old Cattle Rancher's Ranch  
**No one knows his name.**  
**You yell, "HEY, old rancher."**

March

**Agriculture, Soil, Equipment, Cattle,  
 and whatever he wants.**

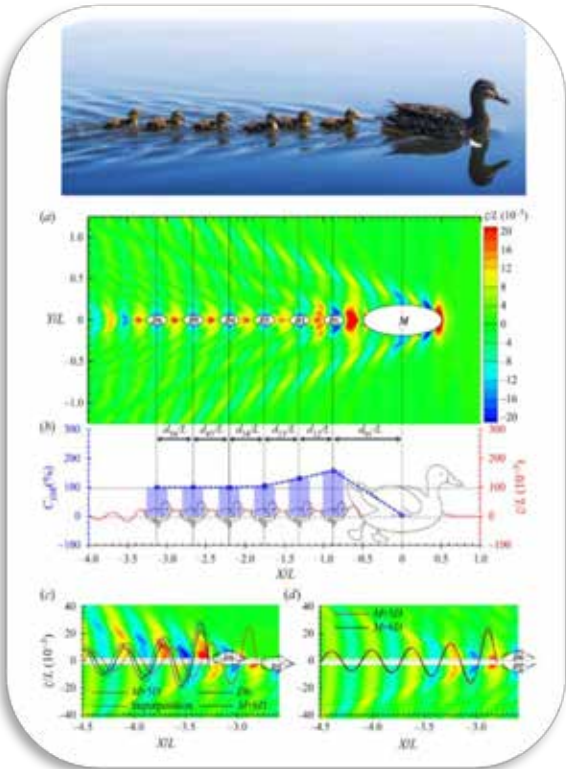
**A beautiful sight is a Mother duck and her ducklings all in formation. I know I showed this last year but it is one of my favorites. Enjoy!**

### Wave-riding and wave-passing by ducklings in formation swimming

Published online by Cambridge University Press:

Zhi-Ming Yuan - Laibing Jia - Atilla Incecik  
 Dept. of Naval Architecture, Ocean & Marine Engr.  
 Univ. of Strathclyde, UK  
 Minglu Chen - Chunyan Ji  
 School of Naval Architecture & Ocean Engr.  
 Jiangsu Univ. of Sci. & Tech., China

It has been commonly observed on open waters that ducklings/goslings follow their mothers in a highly organized formation. The questions arise: (1) why are they swimming in formation? (2) what is the best swimming formation? (3) how much energy can be preserved by each individual in formation swimming? To address these questions, we established a simplified mathematical and numerical model and calculated the wave drag on a group of waterfowl in a swimming formation.



We observed two new and interesting findings: wave-riding and wave-passing. By riding the waves generated by a mother duck, a trailing duckling can obtain a significant wave-drag reduction. When a duckling swims at the 'sweet point' behind its mother, a destructive wave interference phenomenon occurs and the wave drag of the duckling turns positive, pushing the duckling forward. More interestingly, this wave-riding benefit could be sustained by the rest of the ducklings in a single-file line formation. Starting from the third one in a queue, the wave drag of individuals gradually tended towards zero, and a delicate dynamic equilibrium was achieved. Each individual under that equilibrium acted as a wave passer, passing the waves' energy to its trailing one without any energy losses. Wave-riding and wave-passing are probably the principal reasons for the evolution of swimming formation by waterfowl.









This study is the first to reveal the reasons why the formation movement of waterfowl can preserve individuals' energy expenditure. Our calculations provide new insights into the mechanisms of formation swimming.



**Thank you for joining me on my visit to this month's museum. I visit a museum every month.**

I went back to re-visit the [Shelby American Collection](#) - **Cobra, Shelby Mustang and Ford GT 40**

The Shelby American Collection historic car museum was established in 1996 and is located in Boulder, Colorado. Dedicated to the history of Carroll Shelby and the Shelby American Team...The Shelby American Collection celebrates the rich heritage of the Cobra, Shelby Mustang and Ford GT 40 cars that changed the face of auto racing in the 1960s... The museum and their website are dedicated to serve as a resource for all enthusiasts, and to memorialize & preserve one of the most important eras in American automotive history for all generations.

<p><b>Cobras &amp; Coups</b></p> 		
<p><b>GT40s</b></p> 		
<p><b>Shelby Mustangs</b></p> 		<p>The Shelby American Collection is fortunate to display some of the most famous Shelby American cars ever built. This is made possible through the generosity of many Shelby owners and collectors.</p>

**Thank you for joining me on my visit to this month's museum.  
AND, don't forget to join me next month when I visit another museum!**



# RheKen – Town investigative reporter

March



**My name is RheKen and I'm AI. I live on a small ranch on the outskirts of the town.**

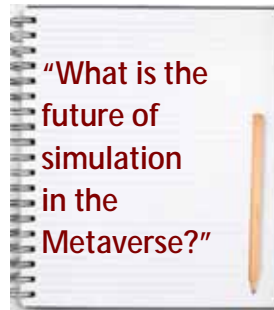
**I use chatGPT for assistance. I'll be documenting our town residents.**

**Now On line - one continuing pdf w/Table of Contents**

**Feb-March on [www.feantm.com](http://www.feantm.com) – or [direct to pdf](#)**



**Why are  
cattle window  
shopping in  
the town?**



**The Town  
Secretary is  
an engineer?**



**Metaverse &  
Engineering  
Simulation**



**What happened  
to the purchased  
clothes & how  
did it happen?**

**Who baked the  
Rhubarb Pie?**



**Who is Pirate?**

**Is that a chicken  
she's holding?**





Goodbye and Come Back Soon



QUIZ and Answers will be back in April



Our Town Salutes our US military,  
NATO and Friends of the US and  
NATO. We salute Freedom.