ODYSSEE

Optimal **D**ecision **S**upport **S**ystem for **E**ngineering and **E**xpertise

Overview:

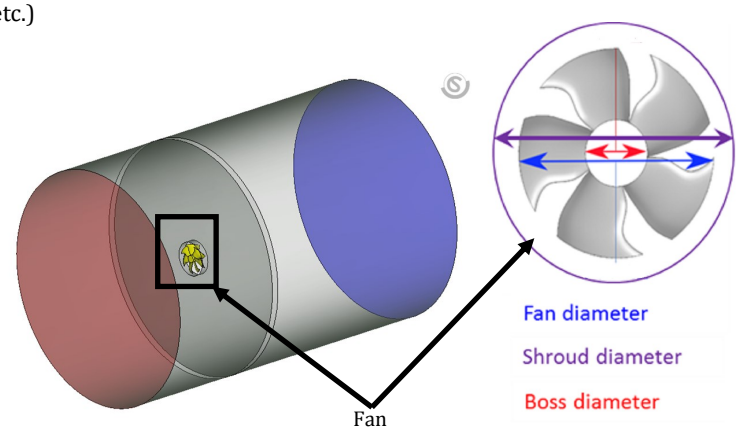
ODYSSEE is a powerful portfolio of 3 modules (**Lunar**, **Quasar** and **Nova**) from **CADLM**. It is a unique and powerful CAE-centric innovation platform that allows users to apply modern Machine Learning, Artificial Intelligence, Reduced Order Modelling (ROM) and Design Optimization to workflows.

ODYSSEE uses Machine Learning and Reduced Order Modelling techniques**:** It employs algebraic or machine learning solutions for reducing the volume of data while preserving the most important parts of the information contained within that data. This is commonly done via decomposition or machine learning or other efficient data fusion techniques. Such techniques allow for creating on-board and real-time applications based on existing experimental or simulation results. Typical applications are optimization, parametric sensitivity analysis and robustness.

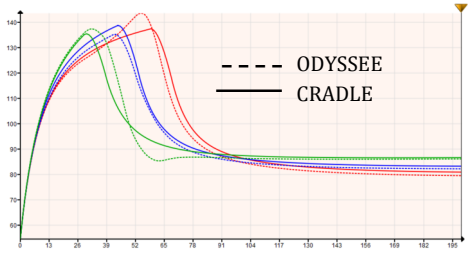
Accurate, Robust Analysis for Diverse Applications:

ODYSSEE is applicable to all industrial design problems. Our main customers are from Automotive, Aerospace, Energy, Biomechanics, Defense, Motorsport, ….

Software and physics independent, it works with Structural, Thermal, CFD, Acoustics, Crash, Biomechanics (MSC Nastran, Marc, Adams, Cradle CFD, Actran, LS-dyna, PamCrash, Radioss, etc.)



DOE 30 runs
X: number of wings, diameters
Y: Outlet mass flow rate
CPU time: 16 min (72 cores)
ODYSSEE : Few sec.
Error:1.73%



Prediction of flow rate by fan shape using Cradle and ODYSSEE

Capabilities:

ODYSSEE provides you with off-the-shelf solutions in order to profit from modern data science technology, allowing for cost effective digital twins applications in

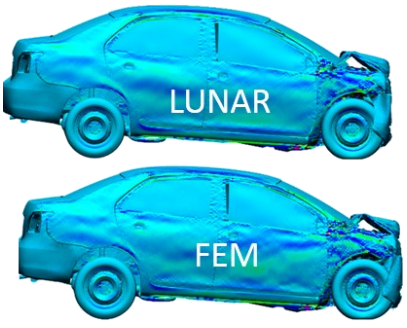
- Real-Time predictive modeling and optimization (CAE or test data)
- Image compression, identification, learning, prediction (Images)
- Fault prediction (Sensor data)

Advantages:

ODYSSEE, helps our clients to reach the following strategic challenges:

- Simulations and optimization in real time which contribute to reducing design time.
- Reduce cost and delay in analysis times as well as computational effort.
- In a period where the planet protection is a priority, it's important to minimize the number of simulation and exploit them efficiently in terms of the delay in performing the simulations and the data storage. With our solution, our client can predict any simulation based on any physics in real time (solver independent), using simply a DOE of few simulations.

DOE 17 runs
X: Rail inner thickness, Floor support thickness, Velocity
Y : Driver seat acceleration, Rigid wall Force, Gravity center acceleration
CPU time: 3 hours
ODYSSEE : Few sec.



Real time simulations used to analyse the thickness frame rails system and absorb the frontal impact the most.

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TRANSFORMING DATA INTO INTELLIGENCE

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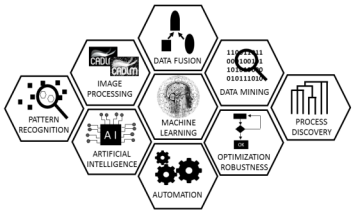


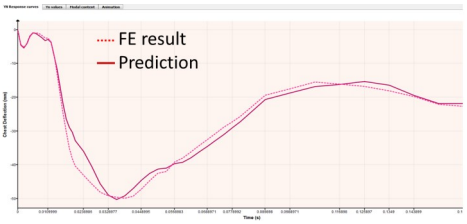
Rethinking Design COST

(Computing, Optimization, Simulation & Time):

Computing

The environmental cost of computing worldwide is reaching that of transport. Increasing number of solvers (often decoupled in terms of the underlying physics), size of models and their CPU cost is hindering innovations, forcing engineers to start from zero at every design cycle thus not exploiting past experience. Numerous design iterations are creating computing bottlenecks in spite of huge advances in hardware and storage solutions.

ODYSSEE, allows to remedy this problem by reducing the effective number of CPU intensive computations, replacing them by real-time equivalents capable of being run on small size laptops.

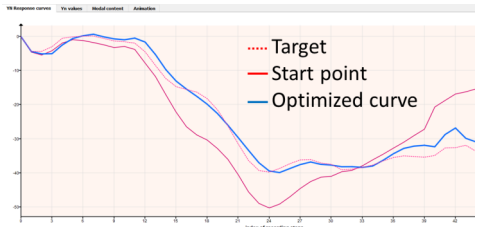


Predict global time responses

Optimization

Reducing the cost of production and design requires optimization of designs and processes leading to efficient manufacturing. While a great majority of engineers are aware of the advantages of optimization techniques, few of them actually have the resources and the opportunity to employ them. Numerous iterations are necessary either over the solver solutions or their approximate surrogates. The existing solutions often ignore the fact that many runs may be avoided using "learning" instead of calculating every single possible combination of design parameters.

ODYSSEE, allows to remedy this drawback by combining optimization and learning in order to provide very precise surrogate models which may be employed at very low computing cost. The gain in total computing effort may be in the order of 1 to 1000 or even more. Robust optimization can in particular benefit from this and allow for running thousands of runs in seconds or minutes.

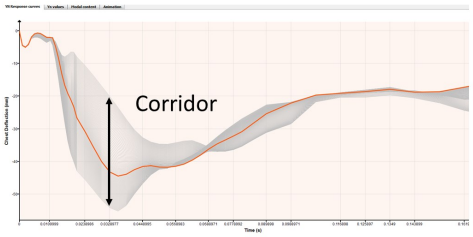


Reverse engineering (Optimization)

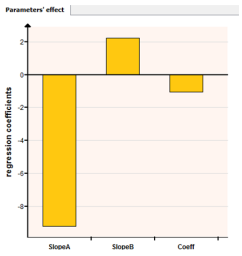
Simulation

A design space is identified by variables or parameters. The associated results are simulations outputs, experimental measurements or both. The primary purpose of simulations is to replace real-life experiments by lower cost and easier to control counterparts. This however, has it limits due to often too complex physics or lack of reliable models. We simply don't have an intermediate solution allowing to learn from experiments or simulations and establish a link between the two, allowing for a "digital twin" or simply a "coupled simulation-experimental" model. Additionally, modeling is often confronted with issues related to licensing, multi-scale considerations and confidentiality, especially in an industrial environment.

ODYSSEE, establishes the missing links and allows for the above enhancements to be made in order to improve the performance, the precision and the feasibility of simulation based engineering.



Population studies (corridors)

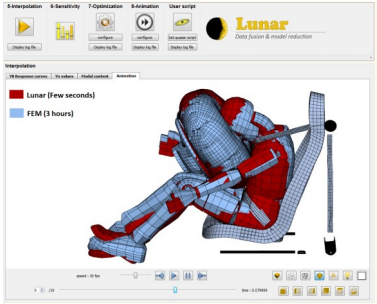


Sensitivity analysis

Time

Even in the case where all the above barriers are overcome, the speed with which new solutions can be obtained and explored remains a major obstacle. Engineering is about "what-if" interrogations and incremental learning. Many decisions do not necessary require a detailed FE model nor an elaborated experiment. This is especially the case in early stages of the design in "V". We can simply learn from our past experience and data and provide real-time answers.

ODYSSEE technology is based on real-time computing; therefore you need little-computing effort for parametric studies and optimization, exploring new horizons in data science in order to capture the most important part of the solution, leaving the details to more elaborate and CPU intensive computing, optimization and simulation technology.



Real Time animation