



esitalk

The Virtual Prototyping Magazine

2017
Issue 50

Supporting the Industry 4.0 Transformation

ESI calls for a new paradigm: the Hybrid Twin™

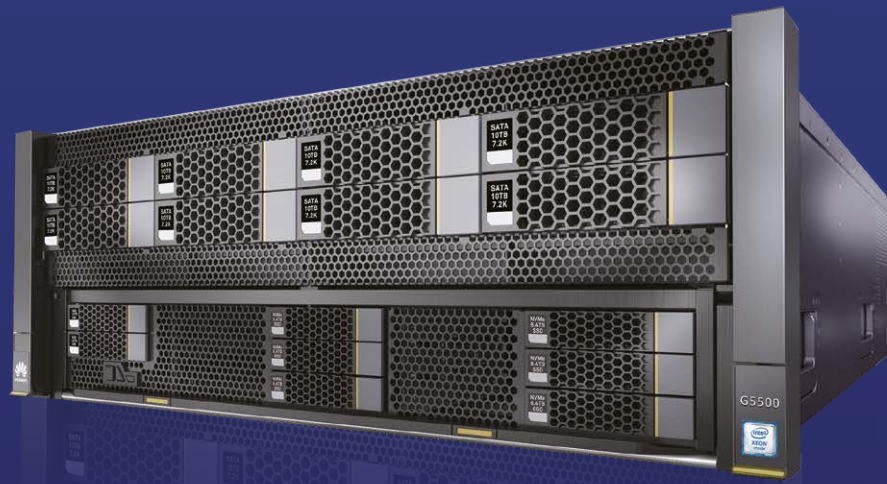
special report

Also in this issue: Customer Successes, Product News and Upcoming ESI Forums

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Editorial

Alain de Rouvray

Chairman & CEO
ESI Group

Dear Reader,

As this 50th edition of *ESItalk* comes as a milestone of sorts, we could pause and gaze upon four decades of collaborative experience with our dedicated customers. As exponential progress in High Performance Computing (HPC) kept unlocking new potentials, together we progressively rose to the challenge of enabling full Virtual Prototyping, necessarily covering the manufacture, assembly and testing of products, and consistently cutting costs, lead times and uncertainty. The level of maturity achieved brings confidence in how to apply the "art of modeling" to the challenges of virtual product development up to pre-certification.

But more exciting than looking back is to look forward at the very real prospects unleashed by the new exponential technology drivers; namely Big Data, Machine Learning and the Internet of Things (IoT). Connected real products and systems in the field now report real-world conditions to a new concept, their virtual Hybrid Twin™, which evolves and becomes more accurate with every cloud feedback. The Hybrid Twin™ erodes the relevance of the staple Product Lifecycle Management (PLM), which aimed at accelerating the development of products meeting *rigid*, predefined specifications and ensuring certification and market fitness. But for the more exacting in-operation fitness, PLM needs be extended to include Product Performance Lifecycle™ (PPL™) allowing the *flexible*, constantly updated monitoring of the product as a living and aging, or faulty, system operated within its own ecosystem. Then through the coherent and predictive simulation of product, environment and real-time interactions, preventive maintenance can be scheduled at the right time, and assisted or autonomous operation becomes a feasible and compelling reality.

This shift in paradigm marks the eve of Industry 4.0, where the Smart Factory becomes the cornerstone of the Outcome Economy with its focus on Lifetime Performance. To this transformation and its expected dramatic benefits, we have dedicated our special report.

In this 50th issue of *ESItalk*, you will read about the challenging steps from Virtual Prototyping to Hybrid Twin™ through the example of a current project with partners that include TWI. We are also delighted to share five of our Customer's Success Stories and information on some of our latest product releases. Talking of autonomous operation, we share how we strive to contribute to the development of autonomous driving beyond current level 3, by simulating the most unpredictable part of the system: the driver himself/herself!

I trust you will find this issue both highly informative and mind opening, and I wish you good reading!

Alain de Rouvray

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Supporting the Industry 4.0 Transformation

ESI calls for a new paradigm: the Hybrid Twin™



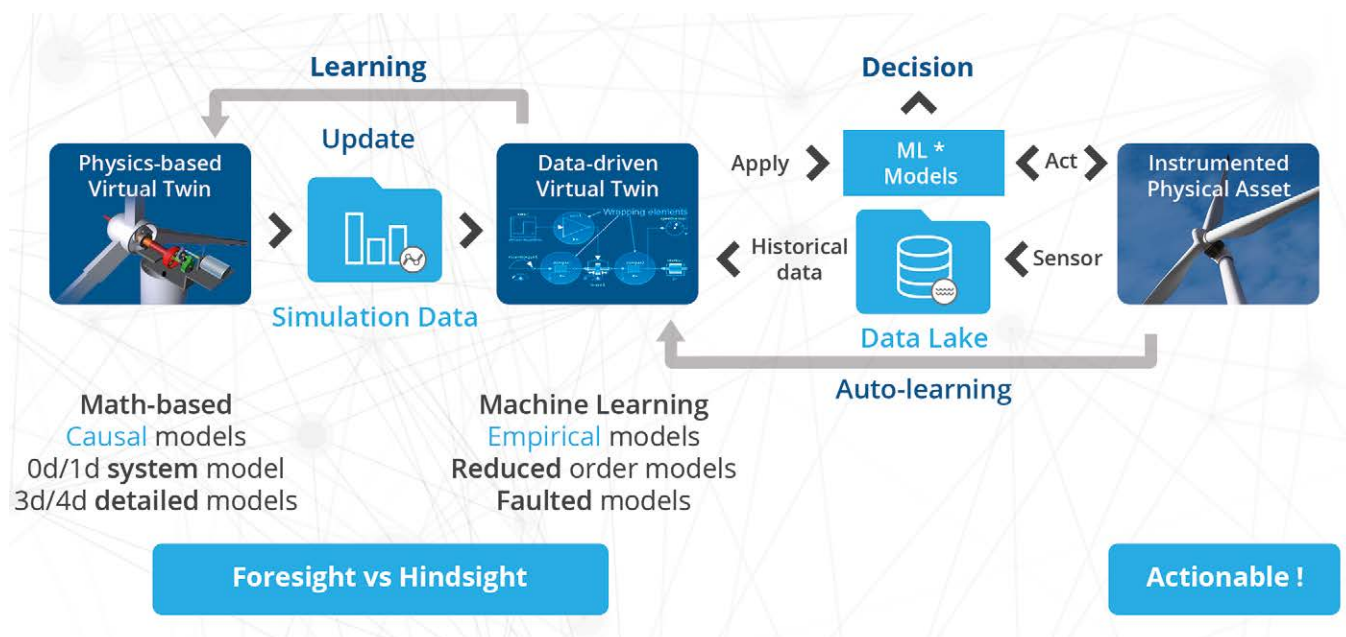
What makes you so sure you want to be the owner of a new car? Some of us crave the feeling of driving and stand in awe before the curves of the latest convertible, but for an increasing number of people a car is just a means to get from A to B. With rent-a-bikes, public transportation and taxi app enabled ride sharing and, very soon, arrays of self-driving autonomous vehicles, getting from A to B no longer means owning a car. As author **Joe Barkai** asserts in his book **“The Outcome Economy”**^{*}, **today’s consumers are not after products anymore, they want solutions to their needs.** In fact, customers of all types are after an “outcome” and we see this transformation happening across all industry sectors. For example, GE (General Electric) has ceased to sell aircraft engines and offers instead hours in flight (what they refer to as “Power by the Hour”). **The product or tool has become irrelevant.** The experience of the product and its outcome are what the customer pays for.

Products are designed to meet predefined specifications. Prototypes of these products are built and tested in an effort to confirm their behavior in standardized, well defined conditions. Thanks to the power of computing available today, such prototypes can be virtual. Consequently, tests can be done earlier and quicker to support the re-engineering loops that lead to an optimized product. Furthermore, virtual manufacturing anticipates the actual fabrication and assembly

processes and then predicts the consequences for the product when it is subjected to a standard set of pre-certification tests.

In today’s “Outcome” economy we can’t stop at certification testing; we have to understand how the product is really used and whether it delivers the expected benefit, or outcome. Here, newly available technologies, including Big Data Analytics and the Internet of Things (IoT), come to bear. Inconceivably large volumes of data can now be captured, processed and interpreted as products are fitted with myriads of sensors that stream live data about use, environment, and condition. **Harnessing this data and updating the Virtual Prototype to a “living” virtual product in-operation gives life to a whole new solution for industrials: the Hybrid Twin™.**

With the Hybrid Twin™, the product is managed in its live ecosystem. As illustrated in the graphic for a wind turbine, the Hybrid Twin™ matures and gains real-life experience; it becomes possible to manage life expectancy by planning preventive maintenance to optimize performance and minimize risk of failure. Such action can include physical intervention and/or over-the-air live updates that adjust the equipment and operational parameters. Moreover, the fact that the Hybrid Twin™ has associated physics-based models makes it possible to examine the consequences of



the actual operating conditions – which can be vastly different from the certification conditions – by simulating the interaction between the product and its in-operation environment.

In the questions answered below by Dr. Soua of TWI, you can read of ESI's leadership in the "WindTwin" project, a collaborative R&D project co-funded by "Innovate UK". The project will develop a comprehensive Hybrid Twin™ solution dedicated to support the Wind Energy sector, in particular providing onshore/offshore wind farm operators with the capacity to intelligently plan preventive maintenance. If we reflect a little we can see that the ideas behind that project are equally applicable to the plant and factory that produce products. When the whole equipment in a manufacturing plant

communicates its status **in real time and we are able** to flexibly adjust parameters based on actual production results, providing alerts and remedial action when there is a batch of non-standard materials or components, or warning of the imminent need of predictive maintenance, then we can truly manage the factory "outcome". That principle is at the heart of the **Smart Factory, or Industry 4.0, and is emerging as industrials are willing to wager that the investment in that future is well worth the return. Indeed the digital transformation is upon us and the Hybrid Twin™ is truly at its foundation!**

* Joe Barkai: The Outcome Economy; How the Industrial Internet of Things is Transforming Every Business (May 25, 2016)

Partners in the WindTwin project

Innovate UK

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UNIVERSITY
LONDON

BIC

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TWI



for more information
www.esi-group.com/smart-virtual-prototyping

3 Questions for...



Dr. Slim Soua

Section Manager - Condition and Structural Health Monitoring,
Structural Integrity Group
TWI



ESI and TWI are expanding their collaboration program. Can you tell us more about the expansion and why now?

ESI and TWI have been collaborating for several years, focusing mainly on typical applications of Computer-Aided Engineering (CAE) in the domain of Materials and Welding Processes. The collaboration has included utilizing existing software capabilities for our in-house research: such as investigating challenging metallurgical & mechanical issues encountered during welding with ESI SYSWELD¹; or leveraging the crash & strength models in ESI Virtual Performance Solution² to develop new concepts for increasing the safety of structures fabricated in composites. We have also worked together on developing new and innovative solutions through large scale collaborative R&D projects, for instance the EU project SIMUTOOL³ which required a simulation platform for manufacturing Composites via Microwave Heating.

Over the last 40 years, TWI has grown significantly and diversified its expertise well beyond materials and joining technologies, including the development of world-leading capabilities in structural integrity management. The Integrity Management Group (IMG) now offers state-of-the-art monitoring solutions,

which is helping hundreds of companies worldwide manage the life of their asset, avoid engineering failure, improve safety and reliability, reduce inspection & maintenance costs, ensure regulatory compliance, and optimize operating expenditure.

Thanks to the ongoing collaboration, we at the IMG team became aware of ESI's strategic plan to expand their solutions beyond Virtual Prototyping to cover the entire Product Performance Lifecycle™ (PPL). To us, a move like this means that ESI is no longer only providing solutions to address issues for the design and manufacturing communities but will now need to assist customers with the challenges associated with the product "In Operation" as well. This creates a clear synergy between ESI's vision and TWI's capabilities. Additionally, the role the Industrial Internet of Things (IIoT) will play in shaping the future of business is overwhelming. The Industry 4.0 initiative, which started in Germany in 2012, is now a global phenomenon and ESI and TWI are set to be a part of it.

The British government, like others in the developed world, is investing in large scale R&D funding programs to support new developments based on the IIoT. In response to a recent call from Innovate UK⁴ (Emerging and Enabling Technologies Round-1), ESI and TWI have worked together, with two local SMEs (Agility³⁵ & Dashboard⁶) and a specialized research group at the Brunel University London⁷, to submit a proposal ("WindTwin") for the development of a comprehensive Hybrid Twin™ solution to be used across the Wind Energy sector. Our bid was successful, the Project started recently and is scheduled for completion in December of 2019.



You mention the "Hybrid Twin™". How is that different from a "Digital Twin"?

This is a great question as the field is still in its inception and the terminology can be confusing.

The term Digital Twin is being used to refer to the digital replica of physical assets, derived from real-life data collected using various types of sensors and monitoring technologies of the asset while in operation. It often means that an analytical data-driven model (i.e. the twin) is built to analyse, update, and/or manage the performance of its physical counterpart. It can use a range of tools and advanced algorithms -- such as Machine Learning (ML), decision making, or even Artificial Intelligence (AI) technologies -- to analyze and visualize the "Big Data" collected.

In contrast, the Hybrid Twin™ is associated with solutions where an additional, complementary virtual model is built. This supplementary model is necessarily physics-based and describes cause and effect relationships.

By its own nature, a Digital Twin - based solution is limited by the number and location of available sensors, as well as by the quality of data collected. For example, we know from our preparations for the WindTwin Project that a typical wind turbine may include six to eight strain-sensors per blade, and one or two temperature-sensors in the gearbox, etc. Such sensors provide a 24/7 stream of data, which is indeed very valuable for monitoring purposes and can be utilized to build, validate, and improve data-derived models. On the other hand, wind farm operators are keen to learn more than just the mechanical and thermal behavior at



the locations of these sensors. They also would like to be able to anticipate the full range of potential consequences when any of these sensors starts sending an uncommon pattern of data, and to have a tool that will enable them to investigate potential actions to avoid failure or degraded performance. Ideally, they would like such a tool to recommend the best intervention; one that minimizes the interruption to operation and also the total cost. Here, the role of high-fidelity physics-based models is crucial and the advantages they bring to the Hybrid Twin™ are very clear.



How do you see the impact of the Hybrid Twin™ in relation to the WindTwin project, and beyond?

The WindTwin project aims to streamline the monitoring and maintenance processes for wind farm operators. Addressing the needs of both onshore and offshore farms, the goal is to increase the availability and reliability of wind turbines. A dedicated Hybrid Twin™ based solution will incorporate all relevant physics at the sub-systems level, supported by sufficient degradation models. Through

the solution, operators will be able to use the WindTwin to diagnose performance variations, and deploy condition-based maintenance, instead of pre-determined, schedule-based strategies. This will undoubtedly reduce downtime, inspection & maintenance costs, enabling operators to virtually test maintenance upgrades before deployment. It will also help better control wind turbine settings in order to optimise performance and energy output.

Worldwide, the total number of wind turbines reported by the end of 2016 was just below 250,000. The market size for operation and maintenance is estimated at about 10 billion USD today and is expected to double by 2022. Under normal operation, the annual maintenance cost is about 5% of the capital investment, but it can be as high as 10% in some cases. The potential economic impact of effective use of a Hybrid Twin™ is clear.

Of course, the increasing pressure to eliminate failure, reduce maintenance cost, optimise performance, etc. is not unique to wind turbines. The list of potential applications goes across almost all industry sectors, such as Heavy Machinery, Aerospace, Defense and Marine.

About TWI

TWI is one of the world's foremost independent research and technology organizations, with expertise in materials joining and engineering processes as applied in industry. TWI specializes in innovation, knowledge transfer and in solving problems across all aspects of manufacturing, fabrication and whole-life integrity management. Established in Cambridge, UK in 1946, the organization has gained a first-class reputation for service through its teams of respected consultants, scientists, engineers and support staff.

¹ ESI SYSWELD: www.esi-group.com/sysweld

² ESI Virtual Performance Solution (VPS) – Composites: www.esi-group.com/VPS

³ SIMUTOOL: www.simutool.com

⁴ Innovate UK: www.gov.uk/government/organisations/innovate-uk

⁵ Agility3: www.agility3.co.uk

⁶ Dashboard: www.dashboard.net

⁷ Brunel University London: www.brunel.ac.uk



for more information
www.twi-global.com

ESI Virtual Performance Solution Helps ŠKODA Score 5-Star Rating from Euro NCAP



"Reliable numerical simulations are fundamental for a successful car body development."

Dipl.-Ing. Arne Leetz

Head of Development Exterior and Interior (EK)
ŠKODA AUTO.

Challenge

Ensuring that new cutting-edge automotive designs meet the latest safety and performance requirements can be quite an obstacle for automakers. This challenge is intensified by the fact that designers and engineers are not able to iterate on designs early in the product development cycle unless they are using Virtual Prototyping.

Benefit

Using ESI Virtual Performance Solution (VPS), ŠKODA engineers were able to virtually test the performance of the car, investigate several options and perform iterations before design was frozen. Using VPS paid off as the ŠKODA Superb received the highest safety rating from Euro NCAP.

different design variants and optimize both the vehicle structure and the passive safety system (such as airbags). The ability of VPS to take into account the manufacturing effects during performance tests facilitates a high level of simulation accuracy.

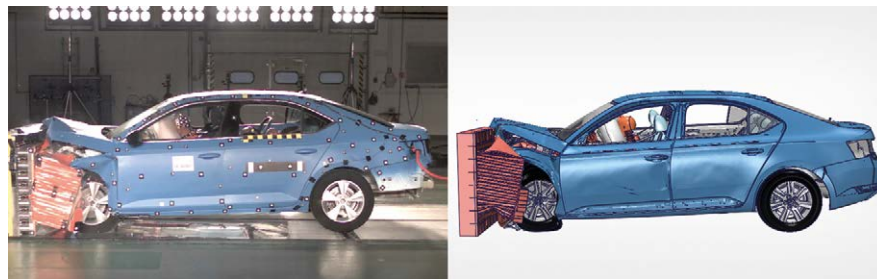
Specific tests can also be conducted to observe the behavior of the car's front, taking into account the latest pedestrian protection regulation. With VPS single core model it is simple to adapt details, such as reinforcement and shape, to be responsive to new regulations while addressing the necessary stiffness.

ESI Group's local subsidiary has been working with ŠKODA for over 20 years: and has played a critical role in assuring that this OEM realizes the full benefits of using ESI Virtual Performance Solution.

"ŠKODA has been using ESI Virtual Performance Solution (VPS) successfully for many years to conduct virtual car crash tests, to ensure the safety of both the occupants and pedestrians, and to check the stiffness or frequency response of car body components such as the hood or headlamps, all on a single-core model. In designing the new and revolutionary ŠKODA Superb, we used VPS early in the development cycle, before design freeze, conducting thousands of virtual tests, investigating different options and design variants, making the best trade-offs, and ultimately obtaining 5 stars at the EuroNCAP."

Tomáš Kubr, Ph.D.

Head of Functional Development (EKF)
ŠKODA AUTO



Physical test versus simulation of a frontal impact with ESI Virtual Performance Solution

Story

Striving to meet recent changes in automotive safety regulations presents new challenges for design engineers. They know they need to take their testing to the next level and for that, they can rely heavily on ESI Virtual Performance Solution (VPS) simulation software.

ŠKODA uses VPS early in the engineering process, before design freeze. VPS's single core model enables users to run thousands of simulations to investigate

It has been possible to investigate and improve proposed new vehicle designs, develop a new generation of passive safety features and incorporate high strength steel into the car body. Relying on VPS, they secured a 5-star rating, from Euro NCAP and were able to bring another highly innovative and safe vehicle to market.

"Virtual Performance Solution (VPS) exhibits continuously improving performance in High-Performance Computing (HPC). Numerical robustness and outstanding stability are mandatory. Scalability and parallel processing techniques have been key items to speed-up solving complex computational problems, making it practical to run the thousands of structural crash and occupant safety simulations needed in car development to achieve best ratings in Euro NCAP test procedures."

Miloslav Pašek

ŠKODA AUTO Support Team Leader
MECAS ESI s.r.o.



for more information
www.esi-group.com/VPS

ESI PAM-COMPOSITES Helps Kotobukiya Fronte Manufacture Sound Absorbing Automotive Carpets



Challenge

In the last decade, major material changes occurred in floor carpets as a shift was made from using rubber to synthetic materials. This increased the manufacturing difficulty and made existing knowledge obsolete. As Kotobukiya Fronte produces roughly 30 kinds of complex synthetic floor carpets, in the thousands every month, they need to be able to adopt new floor designs quickly and ensure a high production rate. Additionally, it is imperative for them to validate and integrate new materials quickly.

Benefit

ESI PAM-COMPOSITES allowed Kotobukiya Fronte to adapt to innovations smoothly and quickly as they switched from sound insulating to sound absorptive floor carpeting. The simulation software enabled them to establish and improve their manufacturing methods quickly, inexpensively and as early as possible in their product development process.

Story

Around 2010, the main function of floor carpets for automobiles changed from sound insulation to sound absorption. This evolution was made possible by using synthetic fiber materials in place of high-density rubber based materials. Because of the positive environmental impact of synthetic fiber material (lightweight, hence less fuel consumption) and its dual function (sound absorption + insulation), sound absorptive floor carpeting has

become the new standard in cars. Their only downfall is that they are difficult to form and require new manufacturing processes.

Today, synthetic floor carpets represent 70% of Kotobukiya Fronte's shipped products. To achieve press forming of synthetic fiber materials, the company has had to overcome several obstacles not encountered when working with rubber materials. First, the initial thickness of the synthetic fiber materials is usually 10 to 20 mm, as opposed to 2 to 3 mm for rubber materials. The thicker the base material, the harder it is to form.

The second issue is managing the thickness variation in the part. The objective is to highly compress the material where strength is required, while pressing lightly in areas where sound absorption is needed. Multiple iterations from the manufacturing department are usually required to optimize these thickness variations and also to avoid the wrinkling that can be associated with such variations.

Finally, the multilayered structure of synthetic fiber floor carpets (three layers instead of two for rubber carpet) increases the complexity of forming. Also, the knowledge base for manufacturing such absorptive materials is more limited than for existing insulations materials that have been in use for many years.

For Kotobukiya Fronte, ESI PAM-COMPOSITES proved to be a time and money saving simulation tool to

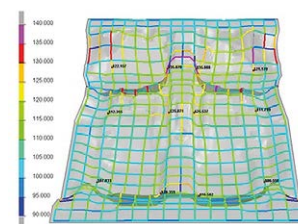
"ESI PAM-COMPOSITES is equipped with the features and parameters necessary for carpet analysis. The analysis accuracy and the usability are excellent, and graphical display of analysis results is easy to understand, which is why we rate it highly. We consult with ESI daily about various matters such as how to reduce calculation time or what kind of modeling is necessary. ESI Japan is also actively and frequently providing information. We recognize that the early practical application of simulation of sound absorption type carpet is largely owed to support from ESI Japan."

Takumi Fujino

Acoustic & Simulation Group / R&D
Department

KOTOBUKIYA FRONTE CO., LTD

overcome forming difficulties. It allowed them to optimize their manufacturing process in order to meet expected product quality and minimize waste. In addition, simulation allowed the company to specifically evaluate different materials. It also helped their process engineers determine the proper gripping system and kinematic of the tools. Simulation helped them determine the proper loading method to guarantee a rapid and right positioning of the initial carpet sheet inside the tools.

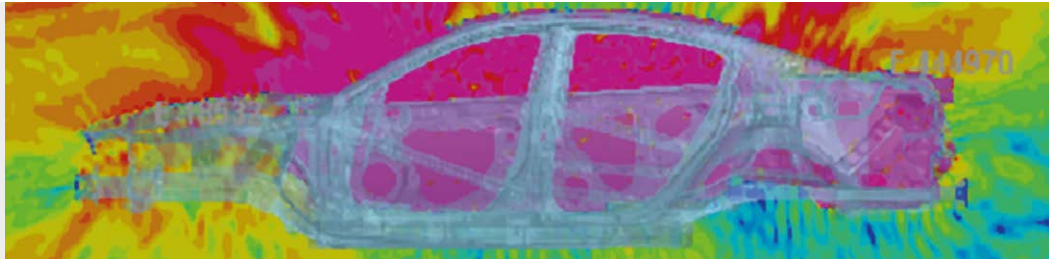


Comparison between simulated (left) and physical (right) grid on thermoformed synthetic floor carpet



for more information
www.esi-group.com/COMPOSITES
www.kf-k.co.jp/e_index.html

Mazda Adopts ESI CEM One Exclusively to Yield the Most Innovative Products



Challenge

As automotive electronics continue to increase, Mazda's Integrated Control System Development Div. must keep up with the increased workload, while meeting deadlines and without compromising a state-of-the-art strategy that features coupled simulation techniques.

Benefit

By integrating the latest version of ESI CEM One – which couples Method of Moments (MoM) with the Finite-Difference Time-Domain (FDTD) method – into their workflow, Mazda was able to decrease time spent on low-value tasks. Now, engineers can focus on producing the absolute best, most innovative products possible.

Story

Mazda Integrated Control System Development Div., a department within

Mazda Motor Corporation, conducts research and development of in-vehicle electronics and its relationship to other related automotive equipment. Electronic equipment includes keyless entry, side collision prevention devices (automotive radar), and the Mazda Connect system (a next-generation car connectivity system that enables users to safely enjoy the convenience of a smartphone when in their car). As technology continues to evolve towards 'connected cars', the number of automotive electronic devices has greatly increased, and will continue to increase, making the internal electromagnetic environment control even more challenging.

To address these growing challenges, Mazda uses ESI CEM One electromagnetic simulation software solution. As users of CEM One since 2010, they upgraded to the newest version in 2015 in order to run Finite-Difference Time-Domain (FDTD) and Method of Moments (MoM) simulations. MoM is best for analyzing

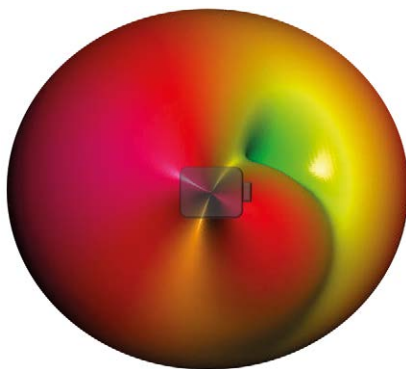
"Compared to before, the amount of time and the number of processes has been drastically reduced using the latest version of ESI CEM One. Thanks to that, we can spend the extra time leading up to deadline on more creative 'trial and error', instead of trivial things like data conversion. We can fulfill our duty and pursue the best product we are capable of producing to our heart's content. During the trial period, it also reconfirmed that the ESI Group technical support is excellent."

Mr. Yasushi Hamada

Staff Manager of Integrated Control System Development Div.
Mazda Motor Corporation

small objects with high accuracy whereas FDTD is optimal for analyzing large objects such as an entire vehicle. Before switching exclusively to ESI CEM One, Mazda was using a different tool for MoM analysis. Since Mazda transitioned to using ESI CEM One exclusively (with coupled MoM and FDTD analyses), all of their analyses can now be run on one single and fully coherent software platform.

Data coordination is running smoothly, the number of hours spent, and processes run have been drastically reduced. In addition, Mr. Yasushi Hamada, Staff Manager of Integrated Control System Development Div., Mazda comments that working with ESI's support team again reminded him of the high quality assistance ESI delivers to their customers. "I have connections with a lot of software companies and ESI's technical support is outstandingly quick and better in quality than most others".



Standalone vs. Integrated Sensor



for more information
www.esi-group.com/CEM-ONE
www.mazda.com

JSP Improves the Accuracy of Their Seat Manufacturing with the Use of ESI Virtual Seat Solution



Challenge

When JSP started to embed plastic and/or metal components into seats fabricated in ARPRO® Expanded Polypropylene (EPP), they discovered that shrinkage after manufacture was more difficult to predict. The CAE methods they applied did not account for thermal effects during shrinkage so simulations of the manufacture were unreliable. Consequently, more trial and error was required resulting in extended development time and increased costs.

Benefit

With ESI Virtual Seat Solution (VSS), JSP was able to define a target shape, including plastic or metal molded inserts, to select the density of their ARPRO® foam, and to calculate the mold shape to be used to achieve the required geometry of each component after the molding and curing process.

Story

JSP is a global supplier of ARPRO® Expanded Polypropylene (EPP) foam, which is used in the manufacture of a wide range of automotive components. ARPRO®, thanks to its excellent strength-to-weight ratio, is widely used in seating

to achieve significant weight reduction. Furthermore, the material is versatile so seats can be readily engineered to control the H-point for different driver/passenger morphologies.

Metal wires can be molded directly into an ARPRO® part. These insert-molded components create integrated sub-assemblies that can be used as primary or secondary attachment features to the steel seat frame or for structural enhancements. The addition of these elements provides opportunity for further weight reductions as the traditional and heavy steel anti-submarine ramp can be replaced.

A typically molded ARPRO® foam part, without insert-molded components, will usually shrink about 2% in volume after a standard molding process. However, the addition of plastic or metal components molded into the ARPRO® part causes the part shrinkage to vary locally and results in dimensional errors in the final molded part, unless the effect is predicted and then corrected in the mold shape.

To accurately predict shrinkage, JSP turned to ESI Virtual Seat Solution (VSS). JSP's first objective was to check the methodology and predictive capability of VSS regarding the final distorted shape of the ARPRO®

"ESI Virtual Seat Solution allowed JSP to accurately predict the distortion of parts as they cured. Consequently, we were able to design molds that compensated for that distortion before they were constructed, saving us a tremendous amount of time, effort and money. This improvement in JSP's capabilities is a competitive advantage that we can use to capture additional business and increase our market share."

Kipp Boegner

Engineering Manager
JSP

foam parts, after they were manufactured and cooled to ambient temperature. Then, with the help of VSS, they looked into predicting the compensation to mold shape that was required so that the desired shape would be achieved after cooling. Lastly, they wanted to output the predicted compensated mold geometry to a Computer-Aided-Design (CAD) file for mold construction.

Today, with ESI Virtual Seat Solution, JSP can input a targeted part shape, including insert-molded plastic and metal inserts, select the desired density of their ARPRO® foam, and run a reverse simulation to predict the corrected mold shape that will be necessary to achieve the targeted part shape after the molding and curing process.

To date, JSP has successfully completed and correlated over 18 independent studies in an effort to validate the capabilities of VSS. Satisfied with the results, JSP has commissioned and constructed five production capable molds based on the output of VSS. These first molds have produced dimensionally capable parts as expected and have required no significant costs for revision.

Displacement scaled 3X for visualization

Initial Condition = Gray
Deformed Shape = Red



Thermal Shrink Simulation – Distorted Shape



for more information
www.esi-group.com/VSS
www.jsp.com/en

Wall Colmonoy Limited (UK) Gets it Right the First Time with ESI ProCAST



WALLCOLMONOY

Challenge

Before utilizing simulation software, Wall Colmonoy Limited (WCL), based in Pontardawe, South Wales, UK, used to leverage their engineering manpower, and brainpower, in order to produce perfect castings. Not only did running physical trials consume valuable time and resources but also it did not guarantee they would achieve a defect-free part in the end.

Benefit

By introducing ESI ProCAST into their part development process, Wall Colmonoy Limited has been able to manufacture their casting right the first time; an objective they strive for every time. They no longer consume time and resources making physical prototypes on the shop floor. Instead, they validate and optimize the manufacturing process before hitting the shop floor.

Story

Wall Colmonoy Limited (WCL) is a leading global materials engineering group of companies engaged in the manufacturing of surfacing and brazing products, castings, and engineered components for aerospace, automotive, oil & gas, mining, energy, and other industrial sectors. WCL manufactures precision cast components, predominantly by investment and sand casting.

Until recently, like most other casting companies, WCL leveraged their vast engineering experience and knowledge and ran physical trials as they sought after the most efficient manufacturing process. However, increasingly complex part shapes, challenging performance requirements, and the demand for shorter turnaround introduced challenges when developing new products; consuming not

only engineers' time but also materials and other resources. The company knew there must be a better way.

In 2016, Wall Colmonoy Limited (UK) began using ESI ProCAST, the widely trusted casting simulation software for the foundry industry, to address the roadblocks they faced. They quickly realized that their engineering expertise coupled together with ESI ProCAST allowed for flexibility, process control, speed to manufacture and ultimately optimal product quality for customers. They could optimize and more efficiently manufacture their castings. ESI ProCAST gave them the ability to engineer quality products in the early stages of development – getting it right the first time. WCL was able to validate and improve their manufacturing processes virtually, without the need for physical trials.

Not only has the software solution aided them in the manufacturing of their existing product line, it will benefit WCL in targeting other markets, especially those that require more intricate cast

"We did a lot of research into the different virtual prototyping software companies out there, but for us, ESI came out at the top as they could provide the best software that met our requirements. The introduction of ESI ProCAST has allowed us to optimize our product development process – delivering new products quicker and expanding our capabilities."

Michael Shreeve

Process Improvement Engineer
Wall Colmonoy Limited

components. Wall Colmonoy now looks to deploy ESI ProCAST at other divisions within their company, including Franklin Bronze Precision Components (FBPC) located in Pennsylvania, USA. FBPC manufactures investment castings for glass container and many other industrial sectors including food, automotive, drilling & mining, marine, steel, and valve & pump.



for more information
www.esi-group.com/ProCAST
www.wallcolmonoy.co.uk

ESI Virtual Performance Solution 2017 Supports the Next Generation of Vehicles

ESI's flagship software solution uniquely addresses the needs of an automotive industry reshaped by new paradigms. To become lighter and greener, thermal engine and electric/hybrid vehicles rely on light-weight multi-material assemblies, including light metals and composites. Virtual Performance Solution (VPS) offers innovative ways to accurately validate the performance of these new structures in an expanding set of domains, including crash, durability, and vibro-acoustics. This enables design and simulation experts to rapidly test their innovations on virtual prototypes rather than real ones.

Furthermore, Virtual Performance Solution offers a distinctive approach: it allows the virtual testing of product performance across multiple domains using a single core model. When needed, models account for the effects of manufacturing processes or use a multi-scale solution scheme. Autonomous driving scenarios can be investigated using human models such as THUMS

developed by Toyota, and by coupling VPS Finite Elements solution with Modelica-based control-command models in ESI's SimulationX. For airbag solutions developed for accident scenarios involving pre-crash maneuvers, VPS offers an accurate and scalable gas dynamics model.

New functionality in VPS 2017 supports passenger acoustic and driving comfort with the introduction of tire models for structure-borne noise studies as well for driving and misuse performance. This is achieved through co-simulation with

FTire (Flexible Structure Tire Model) from Cosin, a physics-based, 3D nonlinear tire simulation model. More than ever, the extended scalability offered in VPS 2017 for efficient High-Performance Computing is key to investigating parallel design options, virtually testing vehicle performance around a single core model, and performing iterations before design freeze.

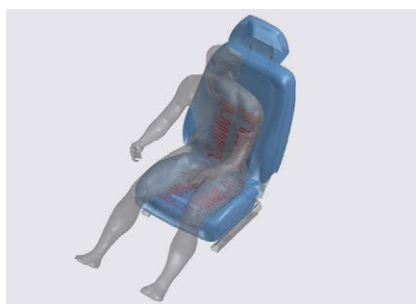


for more information
www.esi-group.com/VPS

Launch of ESI Virtual Seat Solution 2017

Answering new automotive and aeronautic seat challenges

ESI Virtual Seat Solution (VSS) empowers OEMs and seat suppliers to develop, test, improve and pre-certify their seat designs, fully and virtually, without the need for costly physical prototypes.



Thermal comfort on a heated seat

The latest aeronautic version of ESI Virtual Seat solution offers a fully guided Head Impact Criteria (HIC) process and increased precision in the results of this

dynamic test; one of the most challenging pre-certification tests.

With the increased demand for heated and cooled seats, especially in electric vehicles, human models embedded in Virtual Seat Solution 2017 now include human thermal modeling and thermal comfort criteria. This addition also supports the challenge of designing the proper heating system and evaluating thermal comfort.

Besides these improvements, VSS 2017 offers a wide range of new functionalities to predict seat manufacturing, H-Point positioning, seat safety performance and also to evaluate seat comfort for a wide range of the population.

"Using ESI Virtual Seat Solution [...], we can virtually test different designs and material alternatives and iterate as many times as necessary to succeed in the virtual pre-certification of the seat. By avoiding the time loss and the associated cost to correct an unsuccessful real test, we managed to drastically reduce the time to market of our TiSeat."

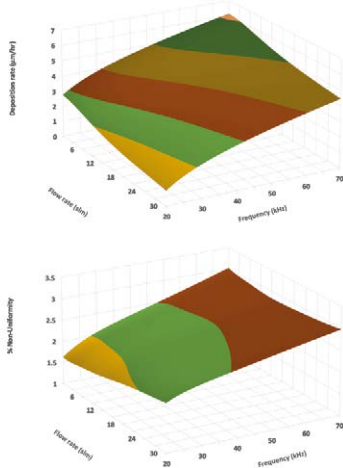
Benjamin Saada
CEO
Explicseat



for more information
www.esi-group.com/virtual-seat

Efficient Design Space Exploration and Sensitivity Analysis with the Latest Release of ESI ACE+ Suite

Design and optimization of complex systems, such as aircraft propulsion, automotive aerodynamics, or semiconductor processing equipment, typically involve evaluating various design parameters to obtain the best outcome. However, conventional Design of Experiments (DoE) approaches are largely unusable for multi-variate



Response Surfaces of Deposition Rate and Non-Uniformity for a CVD Reactor

problems. This is because the number of computational simulations required increase exponentially with the increase in number of design variables.

With ESI ACE+ Suite V2017.5, we are releasing a fast, efficient DoE methodology that allows users to analyze the entire design space with minimal design points, thereby eliminating the curse of dimensionality. With this enhancement, the design study is set-up automatically after the design parameters are tagged and their minimum and maximum values specified. Next, the results from the design study are used to construct response surfaces for the desired quantities of interest. These response surfaces can be visualized to understand the sensitivity of design variables, quantify uncertainties, and identify appropriate input parameter ranges that meet design requirements. Additionally, we construct a surrogate model, also known as a meta-model, that enables users to instantly query results at new points in the design space.

Recently, ESI applied the above methodology to understand and improve the performance of a Chemical Vapor Deposition (CVD) reactor in which the silicon wafer is heated inductively using a radiofrequency (RF) coil system. Along with the RF coil power and frequency, the shape and placement of coils, gas flow rate, and chamber pressure were identified as key design parameters. The new design space exploration approach required only 25 full Computational Fluid Dynamic (CFD) simulations (compared to the prior 1,000) to understand the influence of each design variable. The study revealed that the critical parameters were coil frequency and gas flowrate. ESI built response surfaces for reactor yield (deposition rate) and product quality (non-uniformity). These surfaces were used to identify optimal settings for the process parameters.



for more information
www.esi-group.com/ACE

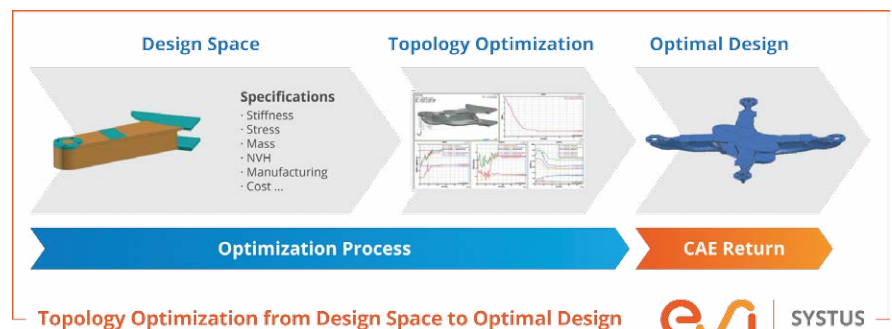
ESI SYSTUS 2017 Release Dedicated to the Energy Sector

ESI SYSTUS benefits from 40 years of R&D in Finite Elements Analysis (FEA). Originally developed by Framatome (now AREVA NP) to support the design of their nuclear power plant, the software is a proven solution for thermomechanical design and regulatory analysis in the nuclear sector.

Now mandated by international standards for nuclear engineering, SYSTUS specifically addresses the requirements issued by the American Society of Mechanical Engineers (ASME) code as well as the French standard known as RCC-M.

ESI SYSTUS 2017 delivers significant new capabilities, including:

- New analytic options and a better legibility of results when conducting regulatory analysis as well as the



introduction of an innovative Differential Method (RCCM-MD) for second category analysis

- Enhancements to investigate fracture mechanics using the innovative X-FEM method, including new and simplified commands to improve software ergonomics

- Topology optimization for many applications, addressing for the first time specific needs in the automotive and aeronautic sectors.



for more information
www.esi-group.com/SYSTUS

ESI Pro-SiVIC: Adding the Driver to the Simulation of Autonomous Vehicles

ESI is extending its expertise in the field of connected and autonomous vehicles. This began in 2015 with the acquisition of Pro-SiVIC, a technology developed within the prestigious French institute IFSTTAR (French Institute of Science and Technology of Transport, Development and Networks). ESI Pro-SiVIC aims to allow vehicle manufacturers to test their Autonomous Driving (AD) systems by generating synthetic data from a high-fidelity sensor model in an ultra-realistic 3D setting, thereby facilitating virtual pre-certification. Connected with ESI's electromagnetics technology for accurate physics-based modeling of sources and sensors, the combined solution delivers incremental gains to the automotive market. Today, ESI Pro-SiVIC enables the development of perception systems from initial design to final performance tests.

Driver in the Loop

With the arrival of the newest Advanced Driver Assistance Systems (ADAS), the industry is one-step closer to full delegation. Nevertheless, it is essential to consider the driver's behavior when managing unknown and critical situations, as well as when the safety system hands the control back to the driver. Adopting a fully virtual approach requires adding a virtual driver and modeling their cognitive behavior and reactions under different circumstances.

A Unique Expertise

As Serge Laverdure explains, the software represents virtually all external parameters for a vehicle, including lighting conditions, climatic conditions, and others on the road. *"We are already considered among the best in the world for sensor simulation and we truly differentiate ourselves with the virtual driver, where we are pioneers. The human models can be used to help develop the human-machine interfaces, which process all available information and take necessary action to gain the driver's attention."*



The cognitive model uses the simulated sensors' input to detect changes in the environment (slow truck ahead, passing car,...) and update situational awareness¹.

The Latest Release

The ESI Pro-SiVIC 2017.0 release focuses on usability. It delivers significant improvements to decrease time-consuming tasks related to scene preparation and the definition of vehicle motion. Interoperability is also improved by enabling the import of external dynamic vehicle models from third parties. The following new features are included:

- **ESI Pro-SiVIC Solvers and Options**
Scenario Preparation Tools – Trajectory Recorder enabling the preparation of new trajectories by manually driving a vehicle in the simulation.
- **Improvements**
Dynamic car models with the capability to use an external Carsim dynamic model.
Scene preparation – Road section system including open drive compliant road section catalog.

Recent Activity

ESI attended DSC 2017 Europe in Stuttgart, Germany – an event dedicated to driving simulation and virtual reality. ESI's Jean-Charles Bornard, PhD in cognitive engineering, led a keynote

session illustrating how the cognitive simulation of the car driver for AD systems development will support the design and validation of new AD systems.

"ADAS systems are classified from level 0 to level 5 and take us from zero to full delegation. The latest systems have reached level 3, which means that the driver is required to control the vehicle under certain emergency circumstances. Introducing a virtual driver in our simulation enables us to address realistic scenarios such as the driver being asleep, on the phone, or looking at a mobile device. By adding this capability to ESI Pro-SiVIC, it is possible to design, integrate and validate driving assistance systems (ADAS) and to review the complete safety decision chain."

Serge Laverdure

Director of the Autonomous Vehicle
Branch
ESI Group

¹ Situational awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.



for more information
www.esi-group.com/PRO-SiVIC

Minimize Cost and Time for Car Body Manufacturing with ESI's Virtual Welding & Assembly Solution

Simulating the full stamp-welding-assembly manufacturing chain for fast distortion engineering in car body manufacturing



Inheriting details of the "as manufactured" components from the press shop, ESI SYSWELD simulates the entire assembly and welding process chain in the body shop; step by step

Lightweight materials used in the automotive sector exhibit more springback and less formability, which can increase the time and cost of design & development of structural assemblies. Engineers typically tweak the production process multiple times before residual stresses and distortions are within specifications. The trial and error method traditionally used in such a process is no longer sufficient and definitely not accurate.

Modeling a Chained Production Process Virtually

Inheriting the details of "as manufactured" components from the press shop, ESI SYSWELD simulates the assembly and welding process chain in the body shop.

First, engineers use ESI PAM-STAMP to simulate the forming of parts from thin metal sheets. The output from the simulation includes the plastic strain, stresses and actual thickness, along with the deformed mesh.

ESI SYSWELD, ESI's welding & assembly solution, imports the deformed shape and other results after stamping. Then, subsequent simulations for

prepositioning, holding and joining are performed. To chain simulations, key data and results must be transferred and mapped from stamping to prepositioning to holding, and finally to the welding simulation model. In order to reduce the time needed to perform such operations, ESI's CAT (Control Adapt Transport) methodology is available.

ESI SYSWELD provides dedicated workflows to include every design feature of a welding assembly process:

- The prepositioning advisor helps engineers create a reference point system (RPS) and ensure that components are placed within the RPS so that gaps are within geometric tolerances. The user begins this process by importing a component and data points; enabling the creation of guides, locators and clamps that help map out the RPS.
- The next tool is the holding advisor, used to define the systems that will

clamp components into place. The tool defines how the clamps will close the gaps between the components before they are joined. Engineers have access to various parameters that define the type, shape, number position, offset and sequence of clamps. Engineers can tweak these parameters until they are optimized to limit product stress and deformation.

- Finally, the user can export the deformed mesh, residual stresses and plastic strain from stamping, prepositioning and holding processes to simulate the welding operation with the defined weld properties. This simulation determines the final distortions and residual stresses from the chained stamping and welding & assembly processes.

"Virtual Prototyping enables design and process engineers to virtually manufacture and assemble components long before their physical prototypes are built and tested. It also shortens time to market and minimizes the cost of manufacturing planning, tryouts and fabrication validation."

Yannick Vincent
Product Manager
ESI Group

After assessing the detailed manufacturing effects of the structural assembly, the user can easily continue the simulation for durability and performance analysis.

Article sponsored by ESI.
Editorial by Shawn Wasserman,



for more information
www.esi-group.com/SYSWELD

Growing Energy Demand Worldwide: How System Simulation Can Help Master the Challenge



The way we build energy systems is notably changing. This is in part because there are new energy sources, which are not only volatile in their supply of power but also fragmented in production and storage. Adding e-mobility to such energy systems creates real challenges.

In this article, Thomas Hofmann, Product Marketing Manager for ESI's SimulationX, explains an approach which helps to understand novel and complex energy systems.

"Green City" with ESI's SimulationX

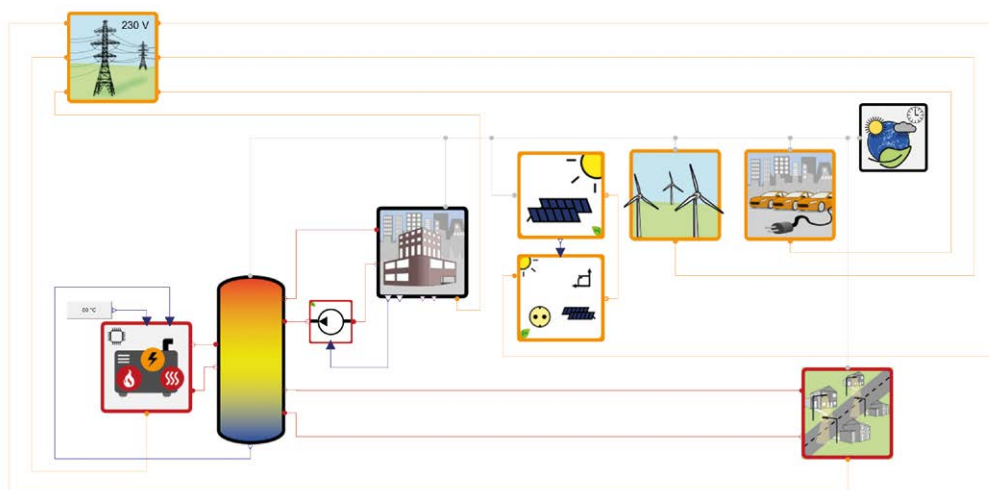
Our intention is to provide significant help in planning efficient energy systems for buildings and urban districts. To do so we must consider e-mobility together with renewable energies and be able to evaluate and demonstrate the behavior of each component.

In many industries, including automotive or aerospace, simulation of multiphysics systems based on a network approach has been an established method for decades. Companies use this method to understand complex correlations in high-tech applications, utilizing the ability to quickly model and simulate machines and plants and all of their technical components. When it comes to energy systems, the challenge is to develop and test efficient and competitive systems, which integrate power and heat supply based on renewable energy sources, and incorporate e-mobility concepts.

As we speak of energy systems for buildings or urban districts – systems that are considerably different from cars,

planes or the components of a power plant – there is a need for dedicated models of energy sources, transmissions, storage systems, and consumers. Such models make it possible to build holistic simulation models of complete energy systems to obtain information about the system's behavior on various levels (from system to component level). Equipped with such models, developers can take their ideas all the way from conception, through commissioning and even to sales.

Let's take a closer look at an example from our "Green City" solution based on SimulationX.



The above image represents a model of a combined heat & power energy system for a small urban district, which can be created to any desired scope. At the lower left corner, a co-generation

plant provides heat, which feeds a heat storage, and electricity, which is fed into the grid. Solar panels and wind turbines (center) provide further electric energy. The fleet of electric vehicles acts as both a consumer and storage vessel of energy. Other energy consumers in this model are an office building (center) and a neighborhood street (lower right).

Each element has time dependent properties and interacts with time dependent environmental conditions (upper right corner). The energy system can be evaluated for a multitude of different scenarios. Through a very effective simulation technology, even periods of several years can be computed on standard office hardware within a very brief time. Therefore, this type of simulation model is a very efficient instrument for proof of concepts, developing system layouts together with their controls, and for predictive operation steering.

In summary, the proven method of system simulation combined with

dedicated models for creating energy systems is able to play a significant role in mastering the challenges of clean energy supply or meet the rising demand from a growing population.



for more information
www.simulationx.com/energy-systems

Simulating Rolling Noise from a Train for Silent Travel

How Engineers Can Measure Vehicle Noise

Sergej Italjancev CAD designer specialist, Mechanical Projects of Škoda Transportation explains that when they first designed a metro train for a bid, his organization was unable to achieve the noise criteria of the tender. However, after applying ESI VA One and the design changes the software led them towards, they won the tender. They are currently supplying eight train units each with six wagons.

In this article, two specialists at ESI comment on some of the technical challenges that Sergej Italjancev faced and how they may be addressed. First, we turn to Trevor Edwards, vibro-acoustics global business development manager, who notes that managing onboard, in-carriage noise on trains is essential to customer satisfaction. "The challenge of on board noise manifests itself to rail designers in the form of acoustic targets at strategic points in the carriage." Given that sources of noise for a train include its equipment, the bogie, the rolling of the wheels on the rail, and external air flow, this is no easy task, as effective acoustic design requires that each source of sound be assessed and managed. Here the toolset of VA One proves effective.

Robert Fiedler, vibro-acoustics specialist at ESI Group, notes that the noise created from the imperfections and roughness of the wheel/rail interface is of particular interest due to its significant contribution. Engineers can't control the rails, but they can design the wheels, their housing and their assemblies in ways that reduce vibration. However, first they need to measure or characterize the sound. Direct measurement is difficult and expensive – and in any case impossible before at least a prototype can be built and tested. "The better approach is to characterize the radiated power coming from the wheel/rail noise with simulation", Fiedler adds. "To model the interaction between the spinning wheel and the rail we can use a simplified analytical approach or the full FEM/BEM (finite element method/ boundary element method), both offered by VA One. The benefits of the latter include having more control of the boundary conditions and being able to model any wheel or track shape required. This is important as different part geometries exhibit different damping."

The next step in the simulation is to calculate the radiated power that is coming from the wheel by modeling the air around the wheel using the BEM

method. After the acoustic radiated power of the wheel is determined, similar decompositions can be assessed from other noise sources. These sources can include the heating, ventilation and air conditioning (HVAC) system as well as the vibration of extruded or composite structures in the train. Once all the noise sources are assessed, they can then be integrated within an SEA (Statistical Energy Method) model to evaluate the noise propagation as a whole.

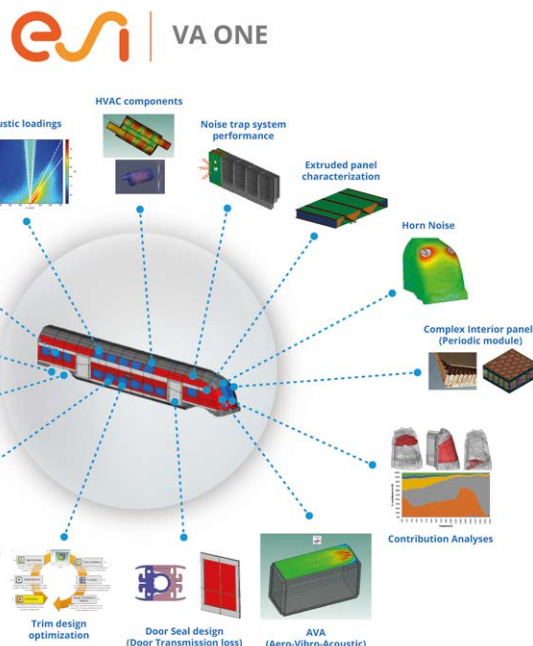
"The method described helped us early in the project phase to identify which structural components of the tram contribute most to interior noise."

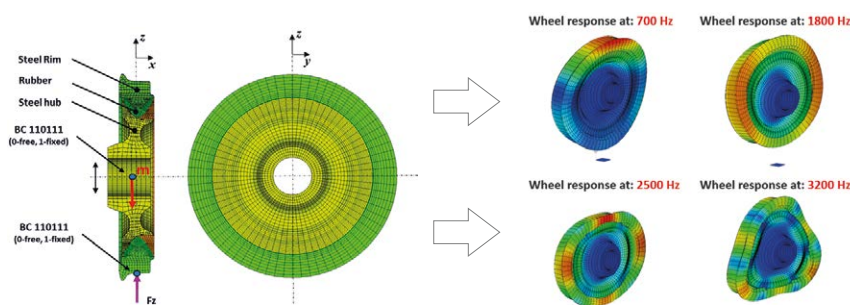
Petr Cuchý

Lead researcher, Field Research Wall
Škoda Transportation

"It is important to focus on acoustically sensitive components and avoid solution of parts that have a minor effect on overall noise and to subsequently avoid adding additional mass and cost to these acoustically insensitive components," says Edwards. "Equally important for us is to have an estimate of expected interior noise levels. VA One calculates and ranks all structural and acoustic paths from the source to a selected point. For example, a cavity (or space) in a train can be selected so that a designer can easily establish the most important noise contributions at that location and take remedial action."

NVH software simulates sound propagation using a source, path and receiver concept. The idea is that the vibrations caused by the source inject energy into the system, which is passed through the structure, substructures and air to the receiver. This is defined as the transmission path. This receiver is typically defined by a specific location, within or external to the source.





With ESI VA One, using FEM/BEM, engineers can model any wheel shape they need to, such as this tram wheel

Edwards explains that it can be quite challenging to determine the interior noise within the cabin due to the fittings and fixtures inside the space.

"The main difference is that interior noise is in a confined space, whereas exterior noise is in an open environment," Edwards says. "The same source, path, receiver model is used, but different frequencies

of interest will require different tools in VA One to perform the calculation."

For instance, depending on the frequency of the sound, something as simple as a seat could absorb the noise, while complex paths contained in structures such as walls and open spaces can diffract, echo or perpetuate the noise.

Using VA One, engineers can use tools to assess the sound levels at a receiver's location, and then determine how features such as carpets and curtains within an acoustic space can absorb the sound.

As a result, engineers can use information from VA One to optimize features within the acoustic space to limit noise. This should be very important when designing the train's interior to optimally limit any whisper of noise propagation.

Article adapted from Shawn Wasserman (July 31, 2017) and produced in collaboration with



for more information
www.esi-group.com/VAOne

Meet ESI at the Following Events

Oct 12, 2017	JEC Multi-material Conference	Don't miss the opportunity to hear from ESI on Multiscale Analysis of Metal /Thermoplastic Composite Interfaces to support the challenge of joining composite with metal, and testing the performances of such multi-material structure	Saint-Etienne, France
Oct 19 - 20, 2017	Aeroacoustics Workshop	Learn how ESI VA One can be coupled with CFD results to predict flow-induced noise without the need for expensive and time consuming physical testing	Wiesbaden, Germany
Oct 19 - 21, 2017	Feel the Future	Experience the power of IC.IDO through LIVE demos with HMD and visit the ESI booth where we will be joined with our partner TC Livarstvo	Cejle, Slovenia
Oct 23 - 25, 2017	American Society for Composites 32nd Technical Conference	Computational Modeling for Advanced Manufacturing. ESI VPS multiscale performance simulation for laser structured Composite-Metal joints	West Lafayette, IN, US
Oct 24 - 26, 2017	Airtec 2017	Join ESI at booth #15 and don't miss our presentation on PAM-COMPOSITES	Munich, Germany
Nov 1 - 3, 2017	JEC Asia 2017	Meet ESI and learn about ESI Virtual Performance Solution for Composites Structures	Seoul, South Korea
Nov 6 - 9, 2017	FABTECH 2017	Visit ESI (booth A5178) and listen to our presentation: "PAM-STAMP Assembly Technologies for Process Design in Sheet Metal Forming"	Chicago, IL, US
Nov 22 - 23, 2017	LIGHTer International Conference	"Future lightweight solutions for multi-sectorial industrial use" is the theme for this year's LIGHTer conference. Come to see ESI's presentation on "How virtual prototyping can support optimal lightweight design based on multi-material component".	Göteborg, Sweden
Nov 23, 2017	Simulation Process & Data Management (SPDM) 2017	Visit ESI 's booth and expand your knowledge of Integration and management of datas of simulation, testing, IoT, system models in the SPDM	Paris, France
Nov 29 - 30, 2017	IoT Tech Expo North America	The World's Largest IoT Event Series will bring together key industries from across America for two days of top level content and discussion. Manufacturing and Smart Factories of the future	Santa Clara, Silicon Valley, US



view all our events:
www.esi-group.com/events

ESI, Ecotre & Colosio Receive the METEF 2017 Innovation Award



FONDERIA VIRTUALE

ESI received the 4th METEF 2017 International Innovation Award in the "Machinery" category jointly with its partners: Colosio S.r.l, Italian High Pressure Die Casting (HPDC) machine manufacturer, and Ecotre Valente S.r.l, ESI's local agent. Their work on the development of an integrated simulation software / press configuration was rewarded at the METEF expo in Verona, Italy in June, where they exhibited their technological innovation to the die casting community.

The METEF Innovation award celebrates originality and innovation in various

topics and emphasizes the performance features and the competitive advantages that companies can offer. In particular, it favors energy savings and eco-sustainability in numerous areas.

ESI ProCAST casting simulation software

is at the core of the project. ESI, Ecotre and Colosio partnered to develop a configuration integrated within the software and the press that supports process improvement and meets cost and quality requirements.



"Finally, a die casting machine and a simulation software are able to communicate properly to facilitate the lives of foundries. Transforming reality into virtual and vice versa is no longer just a project, but a reality for all our customers."

Davide Colosio

CEO

Colosio S.r.l.



for more information
www.esi-group.com/METEF2017

ESI Hosts the 26th Annual Solidification Course

40 casting specialists and world-renowned professors gathered in Switzerland for another great event

ESI's Swiss subsidiary Calcom ESI, in collaboration with Ecole Polytechnique Fédérale de Lausanne (EPFL), held the 26th annual Solidification Course this past May. The event, based in Les Diablerets, Switzerland, welcomed 40 participants, including world-renowned professors from leading universities around the globe who lectured to the group during the week-long course.

After completing the course, Mr. Philip Wilson (Novelis, USA) commented on the new skills he acquired and plans to implement at his company, *"During the design phase of an experiment, I will be better equipped to layout the test parameters as well as understand how to evaluate the results."*

Over the last 26 years, this course has attracted more than 900 participants



Solidification course professors: Prof. Christoph Beckermann, University of Iowa, USA/ Dr. André Phillion, McMaster University, Hamilton ON, Canada/ Prof. Hervé Combeau, Université de Lorraine, Institut Jean Lamour, Nancy, France/ Prof. Jon Dantzig, Professor Emeritus from University of Illinois, Urbana, USA/ Prof. Matthew John M. Krane, Purdue University, USA/ Prof. Andreas Ludwig, Montanuniversität Leoben, Austria/ Prof. Michel Rappaz, Professor Emeritus from Ecole polytechnique fédérale de Lausanne (EPFL), Switzerland

from 328 companies in 38 countries. The course is open to the entire industrial community, from metallurgists, foundry engineers to scientists and researchers, who wish to improve their knowledge in the field of solidification.

The Solidification Course follows content from the book "Solidification" by J.A. Dantzig and M. Rappaz. Registration is now open for Solidification Course 2018.



for more information
www.esi-group.com/solidification-course2018

The Czech Automotive Industry Association Awards MECAS ESI "Company of the Year 2016"

MECAS ESI, the Czech subsidiary of ESI Group based in Pilsen, has been leading ESI's development in Eastern Europe since 2001. Its efforts and commitment to its customers have paid off once again as the Czech Automotive Industry Association (AIA or AutoSAP) chose MECAS ESI as the Company of the Year in the category of companies with up to 250 employees, making it their second award in this category since 2012.

AutoSAP, founded in 1989, represents more than one hundred Czech vehicle manufacturers, suppliers and other companies and institutions in the nations automotive industry. The AIA's main mission is to emphasize the importance of the Czech automotive industry's move towards the vision of Industry 4.0.

Since becoming a member of the AIA in 2004, which is currently comprised of 147 members, MECAS ESI never

stopped expanding the scope of its work in the region. It now helps the AIA raise awareness on the importance of the Internet of Things in the automotive

industry and addresses the "smart factory", Advanced Driver-Assistance Systems (ADAS), autonomous cars, mobility and connectivity.



Karel Luňáček, COO of MECAS ESI (right), receives the award in Prague from top representatives of AIA including Bohdan Wojnar, Member of the Board of Management for Human Resources Management at Skoda; and Pavel Juricek, Chairman of the board of Brano Group



for more information

www.esi-group.com/MECAS-award

www.autosap.cz/en



esi
FORUMS 2017

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ESI Forum in North America
SEP 26-27, Birmingham, MI



5th OpenFOAM User Conference
OCT 17-19, Frankfurt



ESI Forum in Germany
NOV 7-9, Weimar



PUCA Forum in Japan
NOV 15-16, Tokyo



ESI Forum in India
NOV 22, Pune



www.esi-group.com/forums

2016 Annual Results

Full year sales totaled €140.6 million, up 12.7% year over year

Alain de Rouvray, Chairman and Chief Executive Officer of ESI Group, comments: "The performance delivered in 2016, both in terms of growth and profitability, again confirms the relevance of ESI Group's business model and strategic positioning. The significant increase in profitability was achieved without compromise on the R&D investment, which lies at the heart of the Group's competitiveness and sustainability objectives. The growing possibilities offered by the Internet of Things and Big Data now enable a product's lifecycle to be monitored

after commissioning. They create new perspectives of "hybrid" virtual modeling that make it possible to update Virtual Prototypes with data measured in service and in real-time and enhanced by artificial intelligence. This transformative approach, entitled **Product Performance Lifecycle™** and incorporating its disruptive **Hybrid Twin™** solution, provides complete control over a product's entire lifecycle and offers

an essential answer to the key economic challenges of the industry of the future.

The transformation, to be implemented in 2017, should put the Group in an ideal position to tap into the potential growth from the diversification and democratization of Virtual Prototyping and its extension toward the in-service performance, while continuing to improve our profitability".



for more information

www.esi-group.com/company/investors/news/financial-press-releases

ESI Acquires Scilab Enterprises SAS

Making Virtual Engineering solutions more accessible to global engineering & scientific communities

Scilab, published by Scilab Enterprises and widely regarded as the most compelling open source alternative to Matlab®, provides a world-class powerful environment for engineering computation and scientific applications. Scilab now engages an active worldwide community of over one million engineering users and development partners in diverse industries, as well as in education and research.

Vincent Chaillou, ESI Group's COO,

comments: "This acquisition fits perfectly with ESI Group's technology investment strategy. It is aligned with our objective to expand our user base to include all stakeholders involved in the industrial product creation process, starting from the earliest stages of analytical modeling. It paves the way towards the more elaborate 3D-4D numerical simulations of full Virtual Prototyping and eventually of the all-encompassing Immersive Virtual Engineering transformative solutions of Industry 4.0."

About Scilab Enterprises

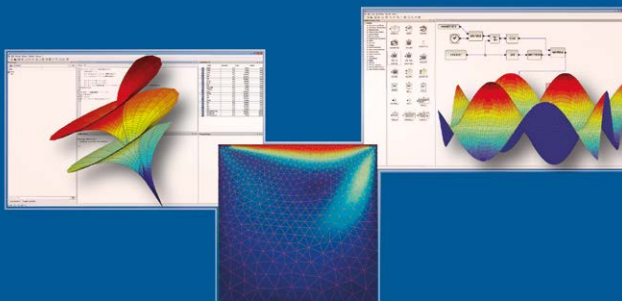
Scilab Enterprises was created in 2010 out of the Scilab Consortium, which was itself created in 2003 as part of an initiative backed by INRIA, the French National Institute for computer sciences and applied mathematics.

"We are very enthusiastic about joining ESI Group, a numerical simulation and Virtual Prototyping global leader, to bring Scilab to a wider range of industrial, academic and research players. Our shared vision will provide the engineering community with the latest generation of analytical solutions to meet current and future numerical simulation challenges."

Raphaël Auphan
CEO
Scilab Enterprises

SCILAB SOFTWARE

20 years of expertise in Simulation & Modeling
packaged in one open source Software



for more information
www.scilab.io

**3 full days
for business**

Exhibition from
10am to 5 pm

Seoul, Republic of Korea
November 1 - 2 - 3 - 2017
COEX, Convention and Exhibition Center

COEX
Convention and
Exhibition Center

Including

- ▶ Exhibition
- ▶ Conferences
- ▶ B2B meetings
- ▶ Innovation Corner
- ▶ Technical Posters
- ▶ VIP Club
- ▶ Job Center
- ▶ Innovation Awards
- ▶ Composites Tours

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01 WEDNESDAY
November

CONFERENCE From 10am to 6pm

KICF

**12th International
Carbon Festival**

Organized by:
KCTECH

02 THURSDAY
November

CONFERENCE From 8.30am to 10.30am

**Automotive: Novelties in structural and
semi structural applications**



AUTOMOTIVE COMPOSITES CIRCLE

From 11am to 1pm (by invitation only)

CONFERENCE From 1pm to 3pm

**What kind of future is there for
composites in IT and E&EE**



INNOVATION AWARDS CEREMONY

From 3.30pm to 4.30pm

03 FRIDAY
November

CONFERENCE From 8.30am to 10.30am

**Developing Automated Processes In
Aeronautics: Tape Laying, Fiber Placement**



CONFERENCE From 1pm to 3pm

**Sports & Leisure: Can Composite
Materials Do Better?**



COMPOSITES TOUR #1 From 3.10pm

KCTECH

Hosted by

COMPOSITES TOUR #2

04 SATURDAY
November



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