NAFEMS americas events

The International Association for the Engineering Modeling, Analysis and Simulation Community

Conference Abstracts

Engineering Analysis & Simulation in the Automotive Industry:

Creating the Next-Generation Vehicle

March 16th - 18th, 2021* | *Online

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Title	Speaker	Company	Start Time
Day 1: Tuesday, 16 March			
Welcome & Introduction (Stage 1)		NAFEMS Americas	**9:45**
Engineering Simulation as Viewed from the Boardroom	Joyce, Bob	Bob Joyce Partners Ltd.	10:00
Computational Simulations in the Ages of E-mobility and Automated Driving	Veress, Arpad	Knorr-Bremse Fékrendszerek Kft.	10:30
Smarter Mobility by Data Driven Simulation of Transportation Networks	Detwiler, Duane	Honda R & D, Americas, Inc.	11:00
Connecting the Simulation	Nalevanko, John	Ford Motor Company	11:30
Case Studies (Parallel Presentations; Stages 1-3)			
From Baja to EV – Using Load Reconstruction in Real Time *(Stage 1)*	Hunter, Tim	Wolf Star Technologies	12:00
Crossing the RUBICON to a Sustainable Future *(Stage 2)*	James, Barry	Hexagon | Romax Technology	12:00
Integrated Modeling & Simulation for Battery Module & Pack Design and Optimization *(Stage 3)*	Birajdar, Nilesh & Pathak, Anand	Dassault Systèmes SIMULIA	12:00
Breakout Rooms (Parallel Discussions - Not Recorded; Rooms 1-14)			
How might future urban communities apply “digital twin” modeling and optimization to provide new value to the residents? *(Room 1)*	Detwiler, Duane	Honda R&D, Americas	12:30

How are simulation tools are tackling the challenges of battery development? *(Room 2)*	Linares, Waldemar	AVL List GmbH	12:30
Vehicle Electrification: Challenges for Startups and Established OEMs *(Room 3)*	Tate, Ed	Dassault Systèmes SIMULIA	12:30
Do we have the proper simulation ecosystem in place to support the current megatrends in the automotive industry: Electrification, Autonomous Driving and MaaS (Mobility as a Service)? *(Room 4)*	Ladzinski, Ed	SMS_ThinkTank	12:30
This time it's different: The role of simulation in the design, development and manufacture of all-electric vehicles *(Room 5)*	Meintjes, Keith	CIMdata & NAFEMS Technical Fellow	12:30
With the shift towards more vehicle automation (incl. ADAS/AD) , what are the challenges facing the virtual validation of these new technologies? *(Room 6)*	Zouani, Karim	Ford Motor Company	12:30
Using Simulation to Perform Cloud-Based Calibration/Diagnostic/Prediction *(Room 7)*	Bambula, Michael	Gamma Technologies	12:30
How is ML/AI being used to help support automotive design and production? *(Room 8)*	Tabaddor, Mahmood	Underwriters Laboratories	12:30
How automation, AI and machine learning will disrupt the CAE industry and the relevant job security in the future, and what skills should we prepare now to face the challenge? *(Room 9)*	Liu, John	Ford Motor Company	12:30
What types of V&V processes is the industry using to assess the processes / algorithms that support autonomous vehicle operation? *(Room 10)*	Salvatore, Frank	SAIC	12:30
Open Discussions *(Rooms 11-14)*	N/A	N/A	12:30

Day 2: Wednesday, 17 March

Brief Welcome (Stage 1)		NAFEMS Americas	**9:55**
Data and Intelligence Requirements for Autonomy and Connectivity	Wijesekera, Duminda	George Mason University / NIST	10:00
Simulation of the Human Factor in Autonomous Driving	Pintér, Krisztián & Felhős, Dávid	Bay Zoltán / NAFEMS Eastern Europe	10:30
Challenges of Developing Safe Vehicles and Improving Traffic Safety for Future Mixed Vehicle Fleets of Human-driven Vehicles, ADS Operated Vehicles, and No-occupant ADS Vehicles on Highway System	Kan, Steve	George Mason University	11:00
Effects of Failures, Weaknesses and Insecurities on ADAS	Wijesekera, Duminda	George Mason University / NIST	11:30
Case Studies (Parallel Presentations; Stages 1-3)			
Assessing ADAS/AD System's Real-Life Performance: Uniting Real Data, AI and Optimization for Scenario-Driven Design Validation and Optimization *(Stage 1)*	Mugnai, Alexandre	Esteco SPA	12:00
Keeping it Cool - A Thermal Simulation Study of the TESLA Model 3 Cell *(Stage 2)*	Schneider, Jürgen & Richter, Jan	AVL List GmbH & Batemo	12:00
Case Study: Integrating Simulation into the Digital Transformation Initiative for Complex Multidisciplinary Systems at MIT Lincoln Laboratory *(Stage 3)*	Rey, Justin & Keer, Tim	MIT Lincoln Lab & Aras	12:00
Breakout Rooms (Parallel Discussions - Not Recorded; Rooms 1-14)			
The ongoing transformation of the Automotive Industry and the ascending role of simulation as a principal catalyst for	Felice, Mario	virsolTech Engineering Consulting, LLC	12:30

success in a very disruptive environment! *(Room 1)*			
Digital Twin, Connectivity and Autonomous Driving: how are they linked and what are the challenges? *(Room 2)*	Popielas, Frank	SMS_ThinkTank	12:30
How do we prepare for the future technology needs of vehicle safety engineering? *(Room 3)*	Kan, Steve	George Mason University	12:30
What is the future of: 1) Hybrid, Plug-in Hybrids Compared to Battery Electric Vehicles, 2) Fuel Cell Electric Vehicles, and 3) Battery Recycling? *(Room 4)*	Gattu, Pallavi	Ford Motor Company	12:30
What is the future of road safety for autonomous vehicles, coherence of communication, automation, cyber security and crashworthiness? *(Room 5)*	Groza, Marton	Bay Zoltán / NAFEMS Eastern Europe	12:30
What would be the main tools that will help engineers within this industry to adapt and grow within the automotive industry? *(Room 6)*	Granados, Eduardo	Ford Motor Company	12:30
Are Systems Thinking, Digital Transformation, and Digital Thread just marketing hype? Does it have anything to do with Simulation Management? *(Room 7)*	Rey, Justin	MIT Lincoln Lab	12:30
How to effectively execute cross-functional and complete product simulations in a typical highly siloed organizational structure. *(Room 8)*	Sheldon, Allen	Honda R&D, Americas	12:30
What does the future hold for manufacturing simulation in the automotive industry? *(Room 9)*	Huang, Joshua	Ryobi Die Casting, USA	12:30
What is the role of simulation in vehicle electrification for the next 10 years? *(Room 10)*	Flores, Kristian	Ford Motor Company	12:30
Open Discussions *(Rooms 11-14)*	N/A	N/A	12:30

Day 3: Thursday, 18 March

Brief Welcome (Stage 1)		NAFEMS Americas	**9:50**
CAE Simulation of a Driving Mechanism for a Three-Wheeler to Enhance Maneuverability and Ride Comfort	Testi, Riccardo	Piaggio & C. S.p.A.	10:00
Rimac C_Two: Development of Electric Hypercar	Krajinović, Ivan	Rimac Automobili d.o.o.	10:30
Electrification in CAE	Garrick, Taylor	General Motors	11:00
Case Studies (Parallel Presentations; Stages 1-3)			
Case Study: Rain management applications with SPH method for vehicle sensors location optimization *(Stage 1)*	Candelier, Julien & Lété, Edouard	Nextflow Software	11:30
Case Study: Block Cycle Durability Schedule Generation for an Elastomeric Control Arm Bushing from 3 Channel Road Load Signals *(Stage 2)*	Mars, Will	Endurica	11:30
Case Study: Optimal Electrified Powertrain Controls along a Real-Time Route in a Multi-Physics Simulation Platform *(Stage 3)*	Bambula, Michael & Lodaya, Dhaval	Gamma Technologies	11:30
Breakout Rooms (Parallel Discussions - Not Recorded; Rooms 1-14)			
What is the role of classical CAE methods for Big Data? *(Room 1)*	Gummadi, Nagesh	Ford Motor Company	12:00
For vehicle automation projects, what is the right balance between simulation and testing for training and for validation? *(Room 2)*	Horn, Emily	Deere & Company	12:00

When will the world reach "peak car?" *(Room 3)*	James, Barry	Hexagon | Romax	12:00
ADAS: What are the strategies for collecting, storing, processing, and sharing volumes of sensor data? *(Room 4)*	Mach, Rod	TotalCAE	12:00
How can universities work with industry partners to promote the creation of the next generation vehicle? *(Room 5)*	Nutwell, Emily	OSU SIMCenter	12:00
Simulating Reality – How do you know the Simulation is correct? *(Room 6)*	Hunter, Tim	Wolf Star Technologies	12:00
What is the Role of the Digital Thread in Creating the Next Generation Vehicle *(Room 7)*	Dreisbach, Rod	NAFEMS Technical Fellow	12:00
Lightweighting and Sustainability initiatives – how are they impacting durability requirements for automotive elastomers? *(Room 8)*	Robertson, Chris	Endurica	12:00
Open Discussions *(Rooms 9-14)*	N/A	N/A	12:30
Closing Discussion (Stage 1)			
Examining the Role of Simulation, Challenges and Solutions to Best Support the Technical Needs of a Fast-Transforming Automotive Industry	Felice, Mario	virsolTech Engineering Consulting, LLC	13:00

Presenter Name: Bambula, Michael

Presenter Company: Gamma Technologies

Presentation Title: Optimal Electrified Powertrain Controls along a Real-Time Route in a Multi-Physics Simulation Platform

Location: Stage 3

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 11:30

Keywords:

Abstract:
In recent years, electrification of vehicle powertrains has become more mainstream to meet regulatory fuel economy and emissions requirements. Amongst the many challenges involved with powertrain electrification, developing supervisory controls and energy management of hybrid electric vehicle powertrains involves significant challenges due to multiple power sources involved. Optimizing energy management for a hybrid electric vehicle largely involves two sets of tasks: component level or low-level control task and supervisory level or high-level control task.

In addition to complexity within powertrain controls, advanced driver assistance systems and the associated chassis controls are also continuing to become more complex. However, opportunities exist to optimize energy management when a cohesive interaction between chassis and powertrain controls can be realized. To optimize energy management along a given route, certain information such as the projected vehicle route, driver behavior, and battery charge level should be considered.

In this case study, simulation models of a parallel P0P4 hybrid electric vehicle are presented, which optimize powertrain controls using the Dynamic Programming approach. This virtual vehicle model is exercised through HWFET and FTP-75 regulatory driving cycles to establish a performance baseline in a controlled driving environment. For comparison to off-cycle driving, the virtual vehicle is then also exercised through a real-world driving scenario over real-world roads, with similar trip characteristics to the regulatory tests, but with real traffic conditions during the day. This comparison provides insights into how optimized real-world fuel economy results can differ compared to the controlled testing environment, and how predictive powertrain controls can offer "in-situ" optimization of energy management.

Presenter Name: Birajdar, Nilesh & Pathak, Anand

Presenter Company: Dassault Systèmes

Presentation Title: Integrated Modeling & Simulation for Battery Module & Pack Design and Optimization

Location: Stage 3

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 12:00

Keywords:

Abstract:

Accelerated vehicle electrification with enhanced shift towards renewable energy has potential to tackle CO2 emission problem and slow down climate change. Automotive industry is undergoing immense transformation to meet the current electrification trend and realize this potential. Consumers have high expectations from the new Electric Vehicles for range, speed and safety. Battery pack - the new fuel tank in a car- is the most vital component to meet these expectations. In order to develop a battery pack that meets these demands of future mobility, - OEM's need to streamline their engineering processes. - The battery pack which contributes to nearly half the cost of the vehicle needs to be compact, lightweight, and well protected from thermal or mechanical safety issues. - Companies also need to modularize these packs to best suit all classes and variants. - Knowing that 90% of decisions are made during concept phase, it is critical to evaluate all the architecture choices of a battery pack. With the current complex and disconnected legacy tools, OEM's are severely limited in the number of concept architectures they can study. To address these challenges, a systems engineering approach combining requirements management, 1-D simulation, parametric 3D modeling, and tightly integrated 3D simulation is used. Combining these approaches accelerates the rate of design iteration and leads to better designs in less time. Firstly, a 1D system is developed to quantify the battery pack performance such as range, max acceleration and max temperature during a drive-cycle. A trade-off is then performed between the cylindrical and pouch cells to meet the battery performance requirements. These system level studies help to finalize the cell form factor and the components of the battery pack architecture. Following-up, a parametric concept model of a battery pack frame is built. The topology, cross sections and layout of structural members of this model is varied to optimize NVH and crashworthiness performance. The detailed battery pack is then built with parametric modules arranged in the optimized frame based on concept study. Finally, this detailed battery pack architecture is validated for crashworthiness and thermal performance. By using CATIA and SIMULA apps on the 3DEXPERIENCE Platform, this battery development process was executed with faster ideation, concept creation, detailed design and validation. Additionally, the integration of all necessary tools into a single user experience reduces time spent on process development and enables quick replication. A case study illustrates these results.

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Presenter Name: Candelier, Julien & Lété, Edouard

Presenter Company: Nextflow Software

Presentation Title: Rain management applications with SPH method for vehicle sensors location optimization

Location: Stage 1

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 11:30

Keywords:

Abstract:

Numerical simulation software based on the Smoothed Particle Hydrodynamics method (SPH) is solving the Navier-Stokes equations with a Lagrangian formulation that extends the reach of Computational Fluid Dynamics (CFD) to new domains. Meshing-free is the main characteristic of the SPH method. Fluid is described by particles which interact with each other. Thereby, engineers can spend time on physics and not on complex meshing. This key advantage opens the door to democratization, as the product is easy to learn and does not require meshing expertise. The setup of a new analysis can also be finalized in few hours (instead of days or weeks) even with complex geometries and/or highly dynamics phenomena, such as rain management applications. Sensors in ADAS and autonomous vehicles have increasingly been used since few years. Camera sensors are extremely sensitive to soiling, as they are located on external part of the vehicle and interact with environmental sources of soiling, such as rain drops, dust, mud. Rain management is also crucial when dealing with driver side mirror view. In this paper, we will review several rain management applications, using key capabilities for treatment of surface tension and aerodynamic forcing, starting with an orphan mesh obtained from a 3D scan and an external aerodynamic flow, previously computed by a traditional CFD code. The starting point is the reuse of the aerodynamic field obtained for car performance study and to add some value to this almost mandatory simulation. The aerodynamic simulation can be obtained from any software/method: Finite Volume Method, Lattice-Boltzmann Method. We have developed an aerodynamic forcing algorithm that allows to deal only with the liquid phase during the simulation and consider the influence of air which is crucial at some driving speed. Considering that SPH method is very versatile when considering boundary motion, we can easily model wiper motion and driver visibility or even study soiling from wheel spray (see figure 1). Engineers can also consider multiscale analysis using local refinement of fluid particles (Chiron et al. (2018)). An additional non-Newtonian model can be used to simulate mud projection on cameras, as well with aerodynamic forcing. The surface tension model can predict the behavior of the mud with different surface treatment and allows optimization of sensor location. Without changing CFD specialists' favorite software and with just little training, we can study advanced challenges in water and liquid simulation. Furthermore, starting from an orphan mesh and not necessarily from a CAD surface, it opens the simulation to new horizons in life sciences or nature, where there is no CAD model to be used.

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Presenter Name: Detwiler, Duane

Presenter Company: Honda R&D, Americas, Inc.

Presentation Title: Smarter Mobility by Data Driven Simulation of Transportation Networks

Location: Stage 1

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 11:00

Keywords: Data, Connected, Digital Twin, Transportation, Simulation

Abstract:

It is widely known that mobility will undergo drastic changes in the next decade as a result of major societal trends such as urbanization, which imposes major challenges to current transportation networks (congestion, pollution, noise, etc.) and emerging technologies such as autonomous, electrified, connected vehicles and artificial intelligence. There is no doubt that future communities will rely on “digital twin” modeling and optimization to provide new value to the residents. In this presentation, we propose a simulation-based strategy to explore the benefits of coordination between existing and emerging travel modes in regional transportation networks.

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Presenter Name: Felice, Mario

Presenter Company: virsolTech Engineering Consulting, LLC

Presentation Title: Examining the Role of Simulation, Challenges and Solutions to Best Support the Technical Needs of a Fast-Transforming Automotive Industry

Location: Stage 1

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 13:00

Keywords:

Abstract:

The automotive industry is now confronting the largest technological transformation since its inception! These having to do with the electrification of powertrains for CLEANER emissions and more efficient consumption; the reinvention of the battery with longer range and fast charging capabilities; the use of smart adaptive technologies for much SAFER driving operations; the application of advanced control sensors and AI for greater CONNECTIVITY between vehicle-to-human, vehicle-to-vehicle, vehicle-to-road/signals; all leading to the arrival of self-driving full autonomous vehicles. Vehicle technology is advancing at lighting speed, eventually leading to the ultimate augmentation of mobility and connectivity. The car will be smart enough to anticipate your preferences and behaviors, providing the ultimate experience in comfort and performance as it transports you from point A to B. The whole concept of passenger transportation is being transformed for a SAFER, HEALTHIER and SMARTER environment. These innovations will need to be delivered at a faster pace of introduction than ever before for car companies to stay competitive. Hence, the challenges to automotive engineers are enormous, needing for SIMULATION to be the critical catalyst in driving the required technical advances and efficiencies for delivering Smart Vehicle technology. The goal for this panel is to engage the participants into an in-depth discussion, examining the role of simulation, challenges and solutions as it relates to each of the outlined technical attributes below. • CLEANER Manufacturing stage --> end of life of the vehicle Electric vs. Hybrid • SAFETY ADAS (Advanced Driver-Assistance Systems) Cybersecurity Crash • SMARTER Connectivity Data Autonomous • EXPERIENCE Comfort Performance Sharing – MaaS (Mobility as a Service) Impact of COVID-19

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Presenter Name: Garrick, Taylor

Presenter Company: General Motors Corporation

Presentation Title: Electrification in CAE

Location: Stage 1

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 11:00

Keywords:

Abstract:

This talk gives a brief overview of some of the capabilities within the Virtual Design, Development, and Validation organization at General Motors. An overview of the virtual workflow for electrified vehicle development is presented and an example design study for a battery cell for electric vehicle applications is detailed.

Presenter Name: Hunter, Tim

Presenter Company: Wolf Star Technologies

Presentation Title: From Baja to EV – Using Load Reconstruction in Real Time

Location: Stage 1

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 12:00

Keywords:

Abstract:

Demonstrated in this paper is the application of Load Reconstruction to a Baja car suspension. Discussed in the paper will be how to extend this technology to an embedded application for EV and other advanced vehicles. The performance of a structural design significantly depends upon the assumptions made on input load. In order to estimate the input load, during the design and development stage of the suspension assembly of a BAJA car, designers and analysts invest immense amount of time and effort to formulate the mathematical model of the design. These theoretical formulations may include idealization errors which can affect the performance of the car as a final product. Due to the errors associated with the assumption of design load, several components might have more weight or may have less strength than needed. This discrepancy between the assumed input load (lab or theoretical studies) and the actual load from the environment can be eliminated by performing a real life testing process using load recovery methodology. Commercial load cells exist in industry to give engineers insight to understanding the complex real world loading of their structures. A significant limitation to the use of load cells is that the structure needs to be modified to accept the load cell and not all desired loading degrees of freedom can be measured. The testing procedure followed in this paper replaced load cells with strain gauges and used strain response in conjunction with a correlation matrix from FEA to estimate the true value of input load under real life conditions. The suspension assembly itself will act as a transducer by converting the load into change in electrical resistance of attached strain gauges. The true load acting on the suspension assembly can be estimated from the strain response recorded from the suspension components. Strain gauge placement was determined using True-Load software which creates a correlation matrix relating to the strain response at the gauge locations due to user defined unit load cases. The strain gauge measurements together with the correlation matrix calculated by True-Load give the best estimate of actual load. After determining the true load, the designers redesigned the structural components that can guarantee a better performance in real life situations. The major objectives of this work are to enhance the total performance of the car by designing components to its optimum performance and to identify the true load acting on the rear suspension components. An extension of this technology can be applied to real time load measurement in the consumer product. The correlation matrix used for load reconstruction can be embedded into a small microprocessor on the consumer product. Robust strain gauges need to be embedded into the consumer product the corresponding strain signals will be sent to the microprocessor. The microprocessor in turn can perform the simple matrix multiplication to calculate the loads and tools may be provided for quality checks on the calculated loading. When a structure can sense the environmental loading in real time, the structure in essence possesses a sense of touch. Control algorithms may be constructed to respond to the touch sensation from load reconstruction. This is ideal for working with the new and highly sophisticated EV marketplace.

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Presenter Name: James, Barry

Presenter Company: Romax Technology

Presentation Title: Crossing the RUBICON to a Sustainable Future

Location: Stage 2

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 12:00

Keywords: e-mobility, Mobility-as-a-Service, CAV, sustainability, rare earth metals

Abstract:

This presentation will talk about RUBICON, a project where Hexagon is studying radical options for future urban mobility. Naturally, EVs are considered, but making transport sustainable is not just about changing the energy source. As vehicles become connected and autonomous, a scenario is investigated where Mobility as a Service (MaaS) is provided by an urban taxi fleet. Cost and CO2 per passenger mile are introduced as key optimization targets, not just for vehicle operation but also accounting for manufacturing, averaged across the lifetime of the vehicle. By operating the autonomous taxi at high levels of utilization, vast mileages accumulate, and the project proposes the design of an ultra-durable powertrain, targeting circa 1m miles of operation. The life cycle costs per mile are thus massively reduced. Further, the design of an innovative, Hexagon-patented permanent magnet electric motor that avoids rare earth metals is presented and is shown to perform far better than conventional solutions on other sustainability measures such as ozone depletion and ionizing radiation. Thus, we see Hexagon committing heavily to sustainability, not only as a supplier of software packages, but as a leader on the sustainability agenda, driving change and being fully cognizant of the challenges and opportunities of next generation vehicles.

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Presenter Name: Joyce, Robert

Presenter Company: Bob Joyce Partners Ltd.

Presentation Title: Engineering Simulation as Viewed from the Boardroom

Location: Stage 1

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 10:00

Keywords:

Abstract:

Simulation has advanced massively over the years and has been fundamental in improving the product creation processes in all industrial sectors. Reflecting on the growth in software, connectivity, engineering, customer product complexity and improving production simulation methods, how can boardrooms exploit the potential of simulations to the fullest? Having started my career over forty years ago by writing gaseous emissions simulation programmes for large industrial engines, I realised early on that effective calculation is far better than testing! Having more recently gained 15 years' boardroom experience driving product development in the automotive industry, I can highlight the use of these methods to the best competitive advantage. This involves clear alignment of all key stakeholders, clear engagement of the system's simulation expertise, looking beyond existing methods and by driving from the top. I hope by giving examples across a number of sectors and technologies, I can engage the audience in good and bad practice to ensure simulation is always at the forefront of product development.

Simulation has advanced massively over the years and has been fundamental in improving the product creation processes in all industrial sectors. Reflecting on the growth in software, connectivity, engineering, customer product complexity and improving production simulation methods, how can boardrooms exploit the potential of simulations to the fullest? Having started my career over forty years ago by writing gaseous emissions simulation programmes for large industrial engines, I realised early on that effective calculation is far better than testing! Having more recently gained 15 years' boardroom experience driving product development in the automotive industry, I can highlight the use of these methods to the best competitive advantage. This involves clear alignment of all key stakeholders, clear engagement of the system's simulation expertise, looking beyond existing methods and by driving from the top. I hope by giving examples across a number of sectors and technologies, I can engage the audience in good and bad practice to ensure simulation is always at the forefront of product development.

Presenter Name: Kan, Steve

Presenter Company: George Mason University

Presentation Title: Challenges of Developing Safe Vehicles and Improving Traffic Safety for Future Mixed Vehicle Fleets of Human-driven Vehicles, ADS Operated Vehicles, and No-occupant ADS Vehicles on Highway System

Location: Stage 1

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 11:00

Keywords: Vehicle Safety

Abstract:

Today, there are increasing number of vehicles equipped with automatic driving systems (ADS) enter onto roadways. While the intended benefits of ADS are very clear, such as alleviating driving fatigue, reducing vehicle collisions, avoiding run off the road accidents and improve overall traffic system, the actual reduction of traffic accident statistics are still too early to provide a clear picture of the effectiveness of the current ADS technology. The challenges that automotive industries and transportation safety community face are enormous for the next 20 years as mix vehicle fleets, regular human-driven vehicles, and ADS operated vehicles, as well as no-occupant ADS vehicles coexist on our highway systems. ADS is a disruptive technology that will bring changes in the established engineering practice of vehicle design, including but not limited to vehicle structural design, occupant safety protections system design, and highway safety system design. This talk will address some of these challenges facing automotive industries so that engineers are fully aware of safety consequences of changing technology. Topics of how to implement vehicle structural design strategies when primary safety protection modes are undefined, and how to develop vehicle occupant protection systems when seating arrangements in ADS equipped vehicles are no longer have to be forward-facing, and the importance of using system level of integrated simulation for virtual testing, will be discussed in this talk.

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Presenter Name: Krajinović, Ivan

Presenter Company: Rimac Automobili d.o.o.

Presentation Title: Rimac C_Two: Development of Electric Hypercar

Location: Stage 1

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 10:30

Keywords: electric hyper-car, simulations, IVI, ADAS, battery, electric motors, Rimac Automobili

Abstract:

This presentation is an overview of engineering efforts invested in developing one of the world's most powerful hypercar for the roads worldwide. In the development of the Rimac C_Two we started from scratch and majority of components was designed, engineered and manufactured in-house. We set out on a mission to create the next generation hypercar, integrating latest technology in electric powertrain, battery design, IVI, autonomous driving and more. Huge part of development was done using different simulation techniques which allowed fast virtual prototyping and smaller amount of development tests. C_Two is technologically most advanced hypercar, truly showcasing our capabilities.

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Presenter Name: Mars, William

Presenter Company: Endurica

Presentation Title: Block Cycle Durability Schedule Generation for an Elastomeric Control Arm Bushing from 3 Channel Road Load Signals

Location: Stage 2

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 11:30

Keywords: Experience - performance

Abstract:

Road load signals recorded at the test track, or generated from vehicle dynamics models are necessary to establish specifications for elastomer part durability. For many tasks, however, the full road load signals contain too much detail and therefore must be summarized in a compact way that preserves damage content and failure mode. We have developed a workflow for summarizing multichannel road load signals that is based on critical plane analysis, and takes into account rubber's nonlinear behaviors. The workflow produces a block cycle schedule consisting of a subset of the key most-damaging motions from the original road load signal, with each block repeated in proportions that closely reproduce the damage and failure mode of the original signal.

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Presenter Name: Mugnai, Alexandre

Presenter Company: Esteco SPA

Presentation Title: Assessing ADAS/AD System's Real-Life Performance: Uniting Real Data, AI and Optimization for Scenario-Driven Design Validation and Optimization

Location: Stage 1

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 12:00

Keywords:

Abstract:

ADAS combines a number of components, including sensors (hardware and software processing), the algorithm fusing the data coming from multiple sensors, the algorithm deciding to act upon those inputs (braking, steering, accelerating), and finally, the actuators that will be implementing the decision. The Autonomous Driving cars shall and will work on the same principles of sensing, perception, decision and control. For ADAS systems (level-1 and level-2 type) [refer to SAE levels], car manufacturers have been validating the algorithms mainly through physical testing - driving vehicles around and ensuring that a limited number of false positives would appear and software fixes will be done through traditional V loop of development and verification. However, with the increase in number and complexity of these functions, and the desire to move towards level-3/4 and level-5 autonomy, a considerable amount of testing becomes necessary for validation purposes, i.e., for certification purposes. In total, at least 5 billion miles of driving would be required for proving with 95% confidence that the autonomous vehicle failure rate is lower than the human driver failure rate, with it being 20% better than the human fatality rate [refer to the RAND report]. The study presented here proposes a method that is timely and financially viable to validate and possibly certify an AD vehicle with extensive usage of simulations. Still to ensure simulation usage is optimized, the starting point is driving data out of which most relevant scenarios are identified. To achieve this objective, an Extreme Value Theory (EVT) algorithm has been created to distinguish critical use cases from rare use cases. This is also combined with an Inverse Reinforcement Learning (IRL) algorithm to have a predictive actor model which brings more realism in the actor behavior when used in a simulation environment.

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Presenter Name: Nalevanko, John

Presenter Company: Ford Motor Company

Presentation Title: Connecting the Simulation

Location: Stage 1

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 11:30

Keywords: Vehicle Connectivity, Digital Twin, Digital Thread, Internet of things, Generative design, Modeling and simulation, Machine learning

Abstract:

The business drivers for Modeling and Simulation continue to evolve as technology improves and new use-cases are defined. Replacing physical testing with a digital version of the same test is no longer the primary mechanism for adding value. Digitally connecting our modeling and simulation artifacts with physical test facilities, manufacturing facilities, vehicles on the road and our customers will create new and larger opportunities for design and engineering efficiency as well as for improved customer insights. This session will discuss some of the new tools, methods, and ways of working that are required to fully take advantage of these new, connected opportunities.

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Presenter Name: Pintér, Krisztián & Felhős, Dávid

Presenter Company: Bay Zoltán / NAFEMS Eastern Europe

Presentation Title: Simulation of the Human Factor in Autonomous Driving

Location: Stage 1

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 10:30

Keywords:

Abstract:

When testing and simulating ADAS systems of autonomous vehicles, in some cases there are no standardized testing methods available. In the recent study, we investigate the control methods of Pedestrian Targets, which are certainly important in the view of the testing framework. We present the concept of ZalaZONE Automotive Proving Ground for testing Advanced Driver Assistance Systems and autonomous vehicles, which is called Scenario-in-the-Loop (SciL). We developed a dynamic obstacle trigger for the SciL which means that the start condition for the pedestrian target is not a static parameter, but a dynamic one depending on the vehicle status. In the second half of the work, I present the used software, and the designed concept for the trigger as well as the validation of it.

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Presenter Name: Rey, Justin & Keer, Tim

Presenter Company: MIT Lincoln Lab & Aras

Presentation Title: Integrating Simulation into the Digital Transformation Initiative for Complex Multidisciplinary Systems at MIT Lincoln Laboratory

Location: Stage 3

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 12:00

Keywords:

Abstract:

The MIT Lincoln Laboratory is a US DoD Federally-Funded Research & Development Center (FFRDC) chartered to apply advanced technology to problems of national security. There is an initiative at Lincoln Laboratory to implement many of the best practices defined in the DoD's Digital Engineering Strategy, which promotes the use of digital representations of complex multidisciplinary systems and components and the use of digital artifacts to design and sustain national defense systems. MIT LL is utilizing a low-code platform to create and maintain a custom digital thread, capturing and connecting data from requirements to systems models, to engineering data and simulation, back to requirements for Verification & Validation (V&V), and manufacturing. A primary goal is to bring simulation out of its traditional silos, significantly increasing its impact on the development of complex products that are, in many ways, similar to those in the current automotive industry – satellites and sensors that must be autonomous, have electronics and software on-board, and communicate with other systems to perform their tasks robustly and in real-time. In this session, Justin Rey, who leads the simulation aspects of the digital transformation initiatives at MIT Lincoln Laboratory, will present an overview of the Lab's Digital Engineering Initiative, including why simulation data and processes need to be an integral part of the digital thread and the system development process. This will be followed by an interactive, visual demonstration of this digital thread, covering requirements, systems modeling and simulation, and closed-loop V&V.

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Presenter Name: Schneider, Jürgen & Richter, Jan

Presenter Company: AVL List GmbH & Batemo

Presentation Title: Keep it cool - A thermal simulation study of the TESLA Model 3 cell

Location: Stage 2

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 12:00

Keywords:

Abstract:

Electric vehicle battery system development is complicated and presents numerous challenges. The skepticism of many customers towards electromobility is highly driven by their concern over long battery charging times. The automotive manufacturer who solves this problem and provides fast charging without aging the battery, will procure substantial market share. Our experts will introduce a battery modeling and simulation-based approach that strictly follows the cell physics. By using a physical, parameterized and validated battery cell model, the anode surface potential is precisely controlled to avoid the dominant aging mechanism of lithium-plating. With that, we derive a feasible development method to calculate fast-charging strategies efficiently, and cope with the various levels of complexity.

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Presenter Name: Testi, Riccardo

Presenter Company: Piaggio & C. S.p.A.

Presentation Title: CAE Simulation of a Driving Mechanism for a Three-Wheeler to Enhance Maneuverability and Ride Comfort

Location: Stage 1

Presentation Date & Time (*EST; New York*): Thursday, 18 March @ 10:00

Keywords: dynamics, multibody, FEM

Abstract:

A CAE simulation was performed to assess the dynamic behavior and the structural performance of a driving mechanism of a three-wheeler; the device was being developed to improve the driving comfort, in particular for specific categories of customers, such as women. MBS and FEM tools were used.

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Presenter Name: Veress, Arpad

Presenter Company: Knorr-Bremse Fékrendszerek Kft.

Presentation Title: Computational Simulations in the Ages of E-mobility and Automated Driving

Location: Stage 1

Presentation Date & Time (*EST; New York*): Tuesday, 16 March @ 10:30

Keywords: Knorr-Bremse Commercial Vehicle Systems, E-mobility, Automated Driving, Technical Modelling and Simulations

Abstract:

The transportation and vehicle industry are disruptively changing today. The megatrends as urbanization, eco-efficiency, electrification and automated driving are driven by the socioeconomic environment, professional diversification, e-commerce and mostly customers' ever higher expectations. The new directions like e-mobility and automated driving require new solutions and products in technical level. Hence, beside the conventional simulation methodologies, new disciplines must be introduced in design and development processes to meet with customers' requirements, standards and needs. The main goal of the presentation is to outline the challenges of the next decade in the commercial vehicle industry with especial care for the virtual modelling and simulations.

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Presenter Name: Wijesekera, Duminda

Presenter Company: George Mason University / NIST

Presentation Title: Effects of Failures, Weaknesses and Insecurities on ADAS

Location: Stage 1

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 11:30

Keywords: Failures, sensors, sensor fusion, learning, attack surfaces

Abstract:

Next generation vehicles will be connected and autonomous – and more likely to be electric rather that depend on hydrocarbons. Until the vehicles transform into a fully connected Level 5 automation, we will depend on ADAS. ADAs depend on having fused sensory systems that has purpose built detection algorithms that have to function in real time. In addition, these systems have to distract the driver and work in multitude of weather and lighting conditions. In order to depend upon these sensors, we need to provide some form of guarantees for each of the operations domains (that may be partitioned based on lighting, precipitation, sand, temperate, weather, noise, electromagnetics, radio noise and road geometry. Given that all sensors are cyber-physical systems that are based on some physical phenomenon, and use detection and or controller activity built into them, they may have failure modes and cyber activity can alter their accuracy that will lead to unacceptable performance degradations. The entire workflow between the sensing and display can be affected by cyber activity. Having a common vulnerability and weakness and a standard set of scenarios with an acceptable set of performance would provide a great help in simulations.

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Presenter Name: Wijesekera, Duminda

Presenter Company: George Mason University / NIST

Presentation Title: Data and Intelligence Requirements for Autonomy and Connectivity

Location: Stage 1

Presentation Date & Time (*EST; New York*): Wednesday, 17 March @ 10:00

Keywords: Maps, accuracy, DSRC, 5G, Objects

Abstract:

Connectivity is a required aspect for autonomous driving, as having an accurate and timely situational awareness in terms of the obstacles are prerequisite for autonomous trajectory creations and navigation. This would require that accurate 3-d maps be available for all roadways in which navigation is desired and all objects that can speak for themselves or not be recognized in real-time. All these require sufficient data and frameworks to simulate vehicles. As the connectivity frameworks change constantly such as going from 4G-LTE to 5G and beyond, simulations will require more data and potentially evolving architecture in order to determine the connectivity aspects, including data rates and communication delay. In addition, their work-case outages are also required to simulate how a connectivity starved automated vehicle will proceed until connectivity is regained. The automation will need to have sufficient failure handling algorithms and failure scenarios to test them. In addition, as the sensors, actuators and control algorithms evolve, more standardized data sets will be required to provide simulating the combination of these systems.

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