

WCX : WORLD CONGRESS

Preliminary Technical Sessions Currently Under Development

-Subject to Change

As of 10/11/2023

Advanced Powertrain/Electric Propulsion		
PFL100	General Powertrain	The General Powertrain bucket covers engine modeling, simulation, control, diagnostics, and optimization for internal combustion engines and powertrain systems in ground transportation. They explore various aspects such as engine performance, efficiency, emissions, and diagnostics. Additionally, there is a focus on multi-dimensional modeling, powertrain control system design, connectivity and automation technologies, high-efficiency engine concepts, and recent developments in propulsion technologies. These sessions highlight advancements in engine technologies and aim to improve energy efficiency, reduce emissions, and enhance overall powertrain performance.
PFL200	Engine Combustion	The Engine Combustion track covers all the topics relevant to the operation of internal combustion engines, from the gas exchange process to fuel injection, ignition, combustion, heat transfer, and emissions. Sub-sessions will focus on spark-ignition combustion systems, compressed-ignition combustion systems, advanced combustion concepts, alternative gaseous fuels, engine controls, and transients.
PFL300	Fuels & Lubricants	Topics on Fuels and Lubricants include: fuel and additives effects on deposits lubrication and emissions; experimental and computational work on fuel sprays and associated spray processes including conventional and non-conventional fuels; measured effects on fuel handling feasibility and measured engine performance and combustion processes in compression autoignition and premixed internal combustion engines, including conventional and non-conventional fuels. Lubricants and greases for current and low carbon and hydrogen fuel engines and transmissions: effects on performance, emissions, efficiency, and durability in compression ignition and premixed combustion engines in both heavy and light duty powertrains, driveline components, transmissions, and electric machines, including battery electric vehicles and hybrids; overall integrated vehicle systems and quantification of vehicle system efficiency from ancillary systems, vehicle hardware, vehicle design, driving characteristics and cycles, including vehicle measurements and modeling.
PFL610	Transmission Systems/ Drive Unit	This session features papers on the automotive transmissions of different types. It includes development of new transmission concepts, transmission enhancements and the advancement of the state of the art of transmission system design & integration with the objective of improving the transmission efficiency, NVH, durability and shift pleaseability.
PFL620	AWD/4WD/Driveline Components	This session will present papers on innovative designs, analysis and models of conventional and electric driveline components. This includes AWD / 4WD units, drive shafts, axles, front & rear drive modules, electric drive units and axle disconnect systems.
PFL640	Driveline Controls	This session features papers on electrified transmission and driveline system controls. This includes regenerative braking, algorithms design and controls, state estimation, mathematical modeling, and system integration controls.
PFL660	Driveline NVH and Launch Devices	This session features papers on transmission/driveline related noise, vibration, rattle issues- and design solutions for conventional and hybrid/electrified applications.

PFL670	Driveline Components / Subsystems	This session features papers on the full array of transmission and driveline related components
PFL680	Driveline Modeling	This session features papers focusing on electrified transmission and driveline modeling, including topics related to hardware, software, and system integration.
PFL700	Hybrid and Electric Propulsions Committee Open Call for Abstracts	The Hybrid and Electric Propulsions track features papers on the following topics: Advanced Hybrid and Electric Vehicle Powertrains, Advanced Fuel Cell Vehicle Applications, Advanced Battery Technologies, Electric Motor & Power Electronics, Development and Optimization of Hybrid Vehicle Controls System, along with Life Cycle Analysis, and to discuss challenges, opportunities and technologies in relation to hybridization and electrification to meet the demands of the automotive industry.
PFL710	Advanced Hybrid and Electric Vehicle Powertrains	This session covers new production and near-production electric & hybrid propulsion architectures, testing, analysis and new concepts.
Battery Energy Storage Systems		
PFL720	Advanced Fuel Cell Vehicle Applications	This session covers advancements in PEM fuel cell applications in vehicles including, but not limited to: advanced materials for cell or stack components, balance of plant (BOP) components, stack or system design, control strategies, modeling, testing, diagnostics and lifetime monitoring, hydrogen safety, durability, economics/cost reduction, and system integration/optimization. These topics can be addressed at the cell, stack, system or vehicle levels. A special focus on durability of stack and BOP components is also planned and topics covering accelerated tests and operating strategies to improve durability are encouraged.
PFL730	Advanced Battery Technologies	This session provides a forum for both theory-oriented and application-oriented manuscripts that address state-of-art battery technologies at the cell, array, pack or vehicle levels. Typical domains encompass, but not limited to the battery component, chemistries, modeling, simulations, testing, diagnosis, prognosis, safety, reliability, durability, battery economics/cost reduction, battery charging, battery thermal management, battery management systems and controls and system integration/optimization.
AE701	Battery Safety Summit	With rapid penetration of battery energy storage systems in the mobility space (surface/aviation/aerospace), knowledge of the various aspects related to battery safety is critical. The purpose of this full day session is to communicate and share information and experience in battery safety related to transportation applications. Attendees will be provided background on EV/Battery related safety regulations, battery safety issues, latest research in the field of battery failure and mitigation technology, and feedback from real experiences dealing with EV incidents from experts. The goal in providing this content is to develop and support uniform safe practices across industry and inform attendees about effective tools and processes to deal with safety issues and incidents.
HX1500	Thermal Management for Batteries and Battery Management	This session covers the technical trends and innovations in battery and battery management system thermal management. This includes the key trends dealing with the thermal needs of battery and battery management systems including thermal management system optimization, packaging, and technology innovations to improve efficiency. Thermal management architecture for optimized performance and the latest means for mitigating battery thermal runaway are covered in this session.
M205	Materials Characterization and Modeling for ICE and BEV	Materials are very important for vehicle design and performance. From internal combustion engines to electrified propulsion systems and fuel cell, material challenges occur in almost every design step for achieving light-weighting, functionality, and performance requirements. This session focuses on material characterization and modeling techniques already or potentially applied to automobile industry. Special

		emphases are advanced material characterization and modeling techniques, microstructure-properties-performance relation, residual stress, failure mechanisms, environmental effects, and material durability related issues in battery and its supporting structures.
Thermal Management		
HX100	Thermal Systems for Hybrid and Electric Vehicles	The purpose of this session is to share experiences and lessons learned to advance the technology in the field of thermal management of electric and hybrid vehicle systems. This session presents papers covering both testing and simulation of hybrid and electric vehicle thermal systems.
HX1100	Thermal Systems for Fuel Cell Vehicles	This session focuses on thermal management of fuel cell vehicles. As we move to mass deployment for Commercial Vehicle and Light duty application the integration of coolant, refrigeration and heating into the electronics and sensor cooling becomes critical. This session is seeking case studies and application of the ever-developing technologies in the aforementioned applications to address hydrogen vehicle needs and the resulting thermal efficiency for consumer acceptance.
HX1300	Automotive Thermal Systems and Components	Proper thermal management can significantly contribute to overall system energy efficiency. TMSS one of the key aspects of the vehicle development. It ensures that the temperatures in the underhood and underbody areas are in desired ranges, that thermal systems operate as designed, and that no component operation is at risk due to excessive temperatures. This session covers the design of thermal components and systems and their vehicle integration.
HX1400	Alternative Refrigerant Systems (R-744, R-123yf, Other Refrigerants)	Currently used refrigerants for the automotive industry are not suitable for heat pump application for EVs. Hence, the future of HFO-1234yf is uncertain as it is not acceptable for EV application, specifically for heating. Also, this refrigerant is a known PFAS, a known chemical that affects human health. Automotive industry is working with refrigerant suppliers to develop an alternative refrigerant suitable for heat pump application that does not affect human health. This session will address the potential shortcomings of the current refrigerant and new or natural refrigerants that can be used as alternatives.
HX200	Vehicle Cabin Air Quality & Human Factors	Cabin indoor air quality is becoming very important as we are spending more time in our vehicles. This is becoming even more important in the post pandemic era. In today's some of the vehicles a unique climate control system with sensors to address the air quality within the cabin to ensure comfort and safety of the occupants. This session will support design and development related to solutions to cabin air quality.
HX400	Thermal Management Strategies	Role of electronics thermal management is crucial for development of autonomous vehicles and for future vehicle powertrain technologies. The purpose of this session is to share novel technologies, lightweight & high efficiency thermal solutions, best practices and lessons learned in the field of electronics thermal management. This session presents papers covering circuit board and vehicle electronics design, testing, simulation and integration of electronics thermal management.
HX500	Powertrain Energy Management	This session considers thermal-fluids modeling (zero-D, 1D, 3D CFD) and experimental presentations. Systems include combustion, lubrication, cooling, fuel, EGR, transmission etc. Components include pumps, fuel injectors, turbochargers, torque converters, gear box, bearings, valves, ports, manifolds, oil cooler, EGR cooler, after-treatment (SCR, DOC, DOF); battery cooling etc.

HX600	Regulatory Issues Involving Thermal Management Systems	Tail pipe emissions are considered one of the major factors adversely affecting the environment. There is an urgent demand in many regions of the world to reduce the carbon footprints due to transportation. Smog generated from mobility applications has crippling effects in mega urban areas. The increasing focus on fuel economy and emissions reduction have caused a rapid expansion of sustainable mobility applications. Electrification of cars and trucks will significantly reduce the dependence on the internal combustion engine using fossil fuels, leading to a significant positive impact on cleaning the environment. In this panel discussion, the focus is on the rapidly changing regulations landscape and the technological advances required to achieve the fuel economy and emissions mandates.
HX700	Thermal Modeling and Simulations	The session will focus on the use of latest simulation technologies in the design and evaluation of new thermal systems and their control strategies. Contributions will focus on both 1D and 3D simulation tools as applied to steady and transient phenomenon.
HX800	Thermal Systems for Commercial and CON/AGG Vehicles	Heavy-duty on- and off-highway vehicles face unique thermal management challenges which can be very different from the thermal challenges in other transportation sectors. This session focuses on topics and technologies specific to thermal management for these vehicles.
HX900	Waste Heat Recovery	Increases in energy cost combined with more stringent emissions standards has made the need to increase overall energy efficiency a critical part of the vehicle development process. The capture and reuse of waste energy is a way of improving overall energy efficiency. This session deals with methods for waste heat recovery and its use for improved energy efficiency.
Infrastructure		
AE400	Smart Transportation and Infrastructure	This session is seeking submissions focusing on Intelligent Transportation Systems and their associated technologies. Abstracts addressing case studies or research could include smart transportation, Automated Vehicles 3.0, V2I/V2X, testing and simulation, roads and infrastructure technologies, and similar mobility and transportation topics. Projects exploring automotive-specific applications of technologies such as 5G, edge computing, artificial intelligence/machine learning, and cloud-based application will also be considered.
AE404	Smart Transportation and Infrastructure: V2X-Interactions among Vehicles and Others	In this session, V2X-interactions among vehicles and others, an important part of the smart transportation and infrastructure concept, is discussed. Vehicle to Everything (V2X) refers to the communication between vehicles and other road agents such as pedestrians, aerial vehicles, etc. V2X based models can be utilized to decrease energy consumption and emissions in vehicles, as well as improve safety. This session includes topics such as valet parking of autonomous vehicles, pedestrian to vehicle (P2V) communication, vehicle speed optimization for traffic lights.
AE600	Electrification: Chargers and Charging Electronics Architecture/Design	As the industry has moved to Electrified Vehicles, the need for chargers and Charging Stations have increased in quantities almost exponentially. We are seeking papers and / or oral presentations that explore all the issues of charging, charging controls, Energy / Power Management, charger to vehicle communicate, charging architecture and charging components. Some of the Topics that could be included are: Vehicle to Grid, Conductive and Wireless Vehicle Charging, Vehicle Charging Standards, (example SAE J1772, SAE J2954J, ISO 15118), New/innovative solutions for the existing HV Vehicle Charging Level 1, Level 2 and DC Fast Charging (Level 3).

AE601	Electric Infrastructure	As the number of EVs sold increases, it is critical to evaluate and plan strategies on infrastructure development to facilitate Smart Charging and Charging EMC/EMI that are environmentally impactful. Municipalities and electric companies know that with public policy and consumer concerns, electricity generation and utility development must be cleaner than current operations. This session is seeking speakers to present their work in cost-effective, large-scale infrastructure development that can accommodate mass utilization of EV charging. Topics for consideration include; development of green energy through solar, photovoltaic, or other sustainable energy models, utilizing existing power grid connections for effective business models in charging station development, public/private partnerships and effective public policy to support large scale deployment. Additional topics include harmonic distortion impact to the power grid and mitigation techniques to eliminate the harmonics and minimize EV's adverse impacts on power grid.
Integrated Design and Engineering		
AE500	AI and Machine Learning	This session focuses on real-world and theoretical methods and advanced algorithms in AI, machine learning and related technologies for both inside and outside the Vehicle. Abstracts are being sought on the state of the art in AI and identifying potential applications of AI-bases technologies in vehicle design, control systems, human/machine interface and automated operation, as well as smart mobility and infrastructure of the future.
IDM100	Reliability and Robust Design in Automotive Engineering	This session focuses on reliability and robust design methods, good practices and applications, including among others uncertainty quantification, RBDO as well as accelerated reliability and durability testing.
IDM300	AI and ML in Vehicle-Level Applications	This session focuses on automotive applications of artificial intelligence (AI) and machine learning (ML), including use of connected vehicle data sources, predictive or prescriptive, preventive maintenance, and big data analytics.
M213	Multi-Discipline Interaction and Special CAE Applications	This session will address recent advances in simulation technologies at scales ranging from theoretical development, real world CAE applications, and special simulation techniques for the hybrid, EV, fuel cell and autonomous vehicles. The session focus on the use of the combination of the dynamic, static, linear and nonlinear finite element (FE), mesh free, computational fluid dynamics (CFD), and multibody dynamics (MBD) to evaluate the performance of the vehicle system. Subject coverage topics include: mesh free, geometry-based methods and their applications; Fluid & Structure Coupling; Thermal & Structural Coupling; Electromagnetic and Structural Coupling; 1-D & 3-D Multi-Domain Coupling; Preload/Stress & Manufacture Effect Consideration in Simulations.
SS100	Body Engineering and Design	Body Engineering & Design covers several important areas that are related to vehicle body, including its components such as instrument panel, steering column and wheel, seats, hood, decklid, transmission cross-member, hard mounted chassis, CRFM, etc. Topics included are: Novel concepts, Analysis, Design, Testing, Predictions of strength, stiffness, and fatigue life, welding methods, vehicle body quality, durability, reliability, safety, ride & handling, NVH, aerodynamics, mass reduction, as well as fuel economy.
SS101	CAD/CAM/CAE Technology	This session publishes papers and presentations advancing the knowledge in product design, manufacturing processes, and engineering analysis using the state-of-the-art computer technology. The scope includes such areas as CFD, manufacturing and assembly simulation, crash-worthiness, computational mechanics, mold flow, ride simulation, ergonomic design, NVH, reverse engineering, etc. Developments in numerical methods applicable to automotive engineering problems will also be considered.

SS103	Design Optimization - Methods and Applications	Design Optimization Methods and Application session features papers on new and improved optimization techniques and on application of different optimization methods in component and vehicle design. Methods include deterministic and stochastic optimization techniques. Applications range from noise pressure optimization and vehicle dynamic response optimization to sub-system topology and shape and full vehicle gage and topology optimization.
SS111	Systems Engineering for Automotive	A system engineering approach to automotive systems considers the system's entire lifespan, from idea and design to development, testing, and operation. This guarantees that the system is developed and built to fulfil the needs of all stakeholders, including customers, regulatory agencies, and automakers. This session is seeking manuscripts and presentations on all facets of automotive including electronics, propulsion, body/chassis systems and safety systems which are mandatory to master the complexity of the vehicle of the future.
Materials and Lightweighting		
M102	Advances in Lightweight Materials	This session presents the latest developments in automotive applications of wrought products. The papers cover a wide range of the technical aspects including alloy development, lightweight design, multi-material usage for body structures, process development and simulation as well as performance optimization.
M103	Magnetic Materials for EV Traction Motors	Vehicle electrification has been recognized and strategically taken by almost all the developed countries as well as major developing economies as one of the most important routes to reducing GHG emissions in the transportation sector. The electrification of vehicles not only involves the development of high performance/capacity batteries to ease the range anxiety, but it also needs to reduce the costs and improve the energy efficiency of the propulsion system to enable affordable electric vehicles (EVs) for wide adoption. Like the engine in a traditional internal combustion engine (ICE) vehicle, the propulsion (electric-drive) system is the heart of an EV, and traction motor is at the center of the system. Materials optimization and the development of new materials (e.g. electrical steels, permanent magnets, soft magnetic composites, etc.) play an important role in achieving these goals. This symposium provides a platform for engineers, researchers and stakeholders to share, discuss, and collaborate in magnetic materials development for the manufacturing of EV traction motors.
M104	Applications of Advanced High-Strength Steels and Press Hardening for Automotive Structures	This session provides a forum for researchers and application engineers to disseminate the knowledge and information gained in the area of advanced high-strength and press-hardening steel development and applications in automotive structures, enabling light-weight and durable vehicles with improved safety.
M105	Sheet Metal Forming Technology	This session will feature the latest developments in sheet metal forming technology. Presentations will address general areas of forming processes, formability issues and modeling. These include forming processes (Stamping, hydroforming, gas forming, high temperature forming), formability Issues (springback, edge cracking, stretch-bend failures and fracture), Modeling (materials, forming limits, failure criteria in various deformation modes and process modeling & optimization).
M106	Advances in Metalcasting and Forging	Metalcasting and forging are a few of the oldest manufacturing processes, dating back over five millennia. However, recent advances continue to expand the horizons of metalcasting and forging: new alloys and new manufacturing techniques are leading to enhanced properties, process modeling and simulation tools are enabling better automotive component designs, the increasing use of metal-matrix composites is opening new frontiers in performance, and additive manufacturing techniques such as 3D printing of pattern materials are reducing lead times for prototype parts. This session will cover the latest developments in ferrous and non-

		ferrous metalcasting and forging technologies for the mobility industry.
M107	Failure Analysis of Materials, Components, and Systems	The mobility industry is constantly challenged to provide customers with the ultimate in reliability and durability. As a result, when failures occur during testing or real-world service, it is essential to identify the root cause and take appropriate corrective action in a timely manner. This session will cover failure analysis methodology, fundamentals of failure mechanisms, non-destructive evaluation, fractography, material fatigue testing, fatigue life design for vehicles, material fracture criteria, damage and fracture characterization, fracture prediction in vehicle crash, material fracture behavior in high strain rates, etc., and creative problem-solving case examples of failure analysis and prevention.
M108	NeXTgeneration Automotive Aluminum Technologies	Aluminum and lightweight materials is expected to grow at a faster pace than at any other time. With this comes the challenges of incorporating it into both mixed material and aluminum intensive vehicle designs. This session highlights the work that has been done in Session M108 NeXT Gen Aluminum and M102 and lightweighting.
M109	Magnesium Technology	The interest in Magnesium alloys in the automotive market for new and existing applications is primarily due to their mass reduction potential. Research of magnesium alloys, processing methods including die-casting, sheet and extrusion, enabling developments in durability, corrosion and joining technologies, and development of new applications continues to receive strong interest. The technical papers to be presented in this session reflect these new developments in magnesium technologies.
M200	Fatigue Analysis and Design	1 customer usage development 2 structural stress generation 3 fatigue of metallic material including new lightweight metals 4 fatigue of non-metallic materials 5 fatigue of joints and bearings 6 environmental effects on fatigue performance 7 effect of manufacturing processes on fatigue behavior 8 vibration fatigue 9 probabilistic fatigue 10 microstructure-mechanics based fatigue 11 machine learning 12 battery pack, electrical motor and BEV drivetrain fatigue and durability.
M202	Advanced Analysis, Design, and Optimization of Materials, Restraints, and Structures for Enhanced Automotive Safety and Weight Reduction	This session explores innovative ideas to enhance automotive safety with improved material constitutive modeling, analysis method developments, simulation and pre/post processing tools, optimization techniques, crash code developments, finite element model updating, model validation and verification techniques, dummies and occupants, restraint systems, passive safety as well as lightweight material applications and designs.
M203	Automotive Engineering Testing and Test Methods	M203 is for the presentation of new results, research developments, and applications related to test activities and methods employed in automotive engineering and research. Papers with an emphasis on the application of tests and test methods to automotive design and evaluation are highly encouraged. Papers with a research focus or come from other industries that may have a potential impact on automotive testing and test methods are also welcome.
M204	Optical Measurement and Nondestructive Testing Techniques in Automotive Engineering	Optical based Techniques/technologies for Materials Characterization, Strain/Masurement, Nondestructive Testing, and Validation of Materials Models etc.
M206	Load Simulation and Vehicle Performance: Nonlinear Components/Systems	Focusing on new theory, formulation and modeling of amplitude-, frequency- and temperature-dependent nonlinear components/systems such as rubber and hydraulic mounts or bushings, air spring, shock absorbers, and any joint friction/damping; dynamic characterization through lab and field

		testing; Linearization methodology; Model validation, application, and sensitivity analysis in vehicle system/subsystem simulations; Nonlinear system identification, modeling, and application in testing accuracy improvement, etc.
M207	Load Simulation and Vehicle Performance: Ride Comfort	Focusing on vehicle ride comfort, addressing issues such as ride evaluation, suspension tuning, occupant biomechanics, seating dynamics, and semi-active and active suspensions. Topics may include traditional vehicle primary and secondary ride issues, structural shake, brake pulsation, smooth road shake, power hop, launch shudder, freeway hop, etc. and any new ride issues raised from electric vehicles (e.g. in-wheel motors driven EVs) and autonomous vehicles (e.g. motion sickness prevention through vehicle design and driving pattern optimization).
M208	Load Simulation and Vehicle Performance: Tire and Terrain	Focusing on tire and terrain mechanics modeling, tire model and test development, parameters identification, sensitivity analysis, road profile characterization, interactions between tire, suspension/steering/brake systems, and different terrains, spindle loads/travel variation attributes due to deterministic and rough roads, tire noise, rolling resistance, correlation studies, design of intelligent tires and ADAS, and changes in tire load duty cycles from traditional to autonomous vehicles.
M209	Load Simulation and Vehicle Performance: Multi-body Dynamics	Multibody system modeling and simulation, rigid and flexible body modeling, loads predictions for vehicle body, frame/sub-frame, exhaust system, driveline, and powertrain, modeling of vehicle dynamics simulation and durability loads simulation, process considering vehicle dynamics and durability loads, data processing and analysis, loads sensitivity analyses for model parameters, design load minimization, prediction of loads effects, robust design methods, driver modeling, and system modeling.
M210	Load Simulation and Vehicle Performance: Handling and Dynamics	Focusing on analysis and enhancement of vehicle dynamics performance including handling/braking/traction characteristics as well as robustness and active stability under the influence of loading, tire forces, and intelligent tire technology for improving overall vehicle system dynamics and safety. Influence of load variations and other uncertainties, as well as impact of system hybridization, electrification, and autonomous systems on vehicle dynamics and controls will be discussed. (ADAS related papers should be submitted to M211)
M211	Load Simulation and Vehicle Performance: Autonomous Vehicle Dynamics	In view of the fast pace of autonomous vehicle development and its challenges associated with different applications, this session is to focus on the following topics: Autonomous vehicle dynamics modeling and simulation methodology; Vehicle Dynamics and terrain coupling with sensor performance, autonomy prediction, planning and control in different mobility scenarios; Autonomous vehicle system duty cycle definition and durability performance evaluation; Autonomous vehicle system dynamics performance simulation verification & validation; Autonomy system and software assurance: How we can define and demonstrate the right level of acceptability.
M212	Vehicle NVH CAE Analysis & Testing	This session covers the forefront NVH development in electrical vehicle, ICE vehicle and autonomous vehicle - numerical methods along with test correlation and optimization for NVH issues of full vehicle and vehicle subsystems. All structural components, subsystems and complete systems found in automotive vehicles will be considered. Topics include noise control materials, structure NVH, vibro-acoustics, wind noise and aeroacoustics, intake/exhaust noise and vehicle interior noise, sound quality etc.
M214	Automotive Tribology	This technical session focuses on fundamental and applied research that lowers frictional energy losses and enhances reliability and durability of automotive components. The topics include, but not limited to engine and drivetrain tribology, seals, bearing and gear lubrication, materials tribology, surface engineering, lubricants and additives, computer-aided tribology,

		tribotesting, as well as friction, wear and lubrication fundamentals.
M215	Modeling and Simulation in Composites, Plastics, and Polymers	This session focuses on state-of-art developments in physical testing and modeling of plastics and fiber reinforced polymer composite materials for the automotive industry. Special emphasis will be given to material properties and microstructure modeling during manufacturing processes and material behavior under different environmental and loading conditions. Studies and discussions on innovative theories and experimental methods, constitutive behavior, integrated computational materials engineering (ICME), and CAE correlation with testing will also be addressed. Other materials considered for this session include rubbers, adhesives, metal/plastic hybrid and materials fabricated by additive manufacturing (3D printing).
M216	Welding, Joining, and Fastening	Presentations related to welding and joining of similar or dissimilar materials of plastics, composites, aluminum, magnesium, titanium, and conventional and advanced high strength steels will be given. Papers related to friction stir (spot) welding, ultrasonic welding, resistance welding, arc welding, laser welding, brazing or soldering, riveting and bolting, and adhesive are planned as well. Papers related to strength, fracture and fatigue of welds, joints and fasteners have been invited.
M217	Materials-Environment Interactions	Corrosion, oxidation, erosion, corrosion-fatigue, stress-corrosion cracking, wear, etc. These issues in aluminum and magnesium are immediate challenges to the development of lightweight materials. Modeling, simulation, testing, diagnosis, and mitigation related to these issues are all challenging and fascinating.
M300	Plastic Components, Polymeric, and Composites for EV, AVS and ICE Vehicles	Presentations of this session will address the development of polymeric and composite materials for automotive interiors and exteriors, powertrain components, as well as structural and non-structural applications. Focus is on design, processes, bonding and manufacturing technologies, as well as lightweighting strategies.
M301	Instrument Panels, Seats, and Interiors for EV, AV and ICE-V	This session will feature technical presentations that will discuss new technology and industry insights in automotive interiors. Focus areas include materials, perceived quality, environmental concerns, manufacturing, safety, and durability.
M302	Composite Materials and Structures for EV and ICE Vehicle	This section will provide a forum for engineers and researchers to share the latest developments on the design, manufacturing, characterization, and application of automotive composite materials and structures for next-generation vehicles. Specific topics of interest include but are not limited to: new paradigms of design and development of composite materials; new manufacturing processes of composite materials; novel experiments for characterization of composite materials and structures; damage, failure, and fatigue testing of composites; responses of composites subjected to extreme environments or loading conditions; practical designs of composite structures for all aspects of automotive applications.
M400	Advances in Coatings	Presentations of this session will address application and research on coatings for exterior body and plastics (including polycarbonate) as well as vehicle interiors and underbody/underhood. Focus will be on the 3 - 10-year timeframe.
M401	UV EB Materials for 3D printing and Automotive Applications	Success in cure technology attained through advances photocurable materials, UV Laser technology, lamp development, 3D computer imaging, and the development of novel materials, processes and facilities, are significantly advancing the efforts of energy reduction and vehicle lightweighting resulting in improvements of reduced GHG emissions, manufacturing Cycle Time, Small Footprint

		manufacturing, speedy proto-type development and Additive Manufacturing, all creating a revolution in manufacturing.
M444	Learning from Nature: Biomimicry Advancing Automotive Material Innovations	This session is designed to provide the audience a deeper understanding of how nature is being applied in various physical and chemical ways in order to improve automotive advancements for safety and energy efficiency.
Military Ground Vehicles		
MIL400	Military Ground Vehicles	This session serves as a forum to address the unique challenges, current gaps, and emerging technologies related to the design, development, and manufacturing of military ground vehicles. The scope includes modeling, simulation, performance analysis, optimization, testing, and validation.
Safety		
SS200	Fire Safety	The fire safety session will focus on current developments in the fields of vehicle fire science, statistics, risks, assessment and mitigation. Papers addressing vehicle design, live-fire tests and fire investigation issues applicable to traditional, electric and alternatively fueled vehicles will be presented.
AE304	Foundations of Automobile Electronics: Reliability, Diagnostics & Prognostics for Safety Critical Electronic Systems	On Board Diagnostics have been around for a long time and are well understood and standardized. Huge amounts of diagnostic data have piled up over the years. Many variants and dimensions must be supported. Fortunately, the data is machine readable. This session provides an overview of the evolution of big data techniques to promote prognostic development and shows some case studies for the next generation of prognostics development.
SS300	Automotive Lighting Technology	These papers highlight the interaction of driver vision - which is itself characterized by complexity, flexibility, and high levels of performance—with ever more sophisticated vision technologies to support driver vision. In particular, LED technology continued to advance in the past year, leading to broader lighting applications. Topics covered include lighting design strategy, lighting thermal management, driver fields of view, and characteristics of camera/display systems.
SS301	Human Factors in Driver Vision and Lighting	Visual perception continues to be a critical aspect of overall driver performance. This session offers presentations highlighting new ideas for coordinating the design of warning lamps for emergency vehicles, better understanding of how drivers accomplish the visually difficult task of negotiating intersections, and prediction of the important driver vision variable of driver eye height.
SS302	Human Factors in Driving and Automotive Telematics	As information and entertainment to and from the vehicle (Telematics) become more prolific it is critical to increase our understanding of how the driver understands and uses Telematics functions. Equally critical is how those functions impact the driver. This session will address those issues.
SS303	Human Factors in Seating Comfort	Designing vehicles with good ergonomics is one of the many factors needed to achieve high customer satisfaction. A basic source for comfort (or discomfort) lies in the vehicle's seats. To design for seat comfort requires knowledge of the size of the driver, the structure of the seat, the position of the seat in the vehicle and the trip duration. Papers offers in this session could include topics such as seat back angle, vehicle packaging and trip duration.

SS400	Safety and Performance of Active Safety and Driving Automation Features	This session will focus on evaluating the safety impacts that can be achieved by Active Safety features and Driving Automation features. Topics will include the both the predictive and retrospective safety impact assessments of these technologies, safety benefits for projected systems, the development of a safety case, human interactions and driver monitoring systems, regulatory testing, consumer acceptance, market demand, and subsystem performance assessment of perception, path planning, and other subsystems.
SS500	Occupant Protection: Accident Reconstruction	The AR Organizing Committee are seeking papers focused on the latest research related to methods and techniques for reconstructing vehicular crashes involving wheeled and tracked vehicles, pedestrians, and roadside features. Emphasis is placed on experimental data and theoretical methods that will enable reconstructionists to identify, interpret, and analyze physical evidence from vehicular crashes.
SS501	Occupant Protection	New for WCX 2024, SAE is inviting abstracts under the general heading of occupant protection before subdividing submissions into targeted sessions. Submissions encompassing new research in the fields of active and passive safety including but not limited to structural crashworthiness, occupant safety, and vulnerable road user safety are encouraged.
SS502	Occupant Protection: Event Data Recorders (EDR)	This session includes the latest research on Event Data Recorders (EDRs) equipped in passenger cars, light trucks, and commercial vehicles (heavy trucks and motorcoaches). Emphasis is placed on the application, interpretation and use of EDRs in the investigation of motor vehicle crashes.
SS515	Occupant Protection for Motorcycle Safety	For the WCX 2024, The SAE Occupant Protection Committee is inviting technical abstract submissions focused on "Motorcycle Safety". This topic is currently added to the roadmaps of various New Car Assessment Programs (NCAP) such as Euro-NCAP, SAEAN_NCAP, and is researched by NHTSA and other safety agencies for potential future NCAP/regulatory considerations.
AE101	ADAS and Autonomous Vehicle System: Fundamentals, and Driver Interface	This session addresses technical research related to ADAS and AVS driver interface/human factor, and cross-functional features such as architecture, performance evaluation and new technologies that are not covered by other AD or ADAS sessions.
AE102	ADAS and Autonomous Vehicle System: ADAS/AVS - Perception	This session will focus on presentations from the session authors on the latest research on object detection and tracking methodologies for ADAS and AVS. The areas include detection of static (curbs, lanes, potholes) and dynamic objects in complex real-life scenarios and in difficult weather conditions, using camera, radar and LiDAR sensors. Advanced sensor fusion and Simultaneous Localization and Mapping (SLAM) techniques will also be discussed in this context.
AE103	ADAS and Autonomous Vehicle System: AD/ADAS Path Planning and Control	This session addresses technical research related to path planning and control for ADAS and autonomous vehicle systems. The topics cover latest technologies of both longitudinal and lateral path planning and motion control for various real-world applications, such as vehicle speed control, park assist/self-parking, lane changing, evasive steering, etc.
AE104	ADAS and Autonomous Vehicle System: Localization	This session addresses state of the art technical research related to GNSS, mapping for AD/ADAS systems, novel simultaneous localization and mapping algorithm and any other localization related topics. The audience for this session includes AD/ADAS, robotics and automotive engineers, as well as other individuals interested in perception and localization.
AE105	ADAS and Autonomous Vehicle System: Driver Interface	This session addresses driver interface, human factors and other technical areas that relates to driver/rider interaction, operation and impact related to ADAS and AVS. Specific focus for 2024 will be on In-cabin monitoring. Topics to include driver monitoring (DMS), occupant monitoring (OMS) and using

		camera or radar to monitor the states/conditions of driver or occupants and provide the timely and useful feedback.
AE106	ADAS and Autonomous Vehicle System: Simulation and Testing	This session focuses on simulation and testing methodologies for ADAS and automated driving systems. Development and testing these systems often relies on simulation and advance testing methodologies due to the complex operating environment
Smart Manufacturing		
MFG200	Intelligent Manufacturing / Industry 4.0	This session focuses on AR/VR, collaborative robots, digital twin, robotics, artificial intelligence (AI)-including machine learning, big data-including predictive analytics, predictive/preventative maintenance, industrial internet of things (IIoT), virtual manufacturing, and other smart manufacturing technologies.
MGF300	Additive Manufacturing	This session is seeking case-studies on the development, implementation, and optimization of designs for different strategies in additive manufacturing that include both metal and non-metallic materials. We are asking for authors to provide in their manuscript's examples of appropriate AM technology for specific design-manufacturing applications; to identify and explain design challenges; and where appropriate showcase solutions that identify software tools, evaluate existing designs for workflow; and design parts that leverage the strengths of AM.
Sustainability/Emissions		
DEI100	The Future of Mobility and How to Achieve Equitable Mobility for All	This session will address what are the challenges facing industry for the built environment, the user and of the technology in creating equitable mobility. This session is seeking abstracts that will provide thought-provoking insights on designing vehicles and infrastructure that creates equitable mobility for future state vehicles based upon user needs. We are also seeking case studies on what it takes to make it happen in today's current environment.
PFL400	Mobile Emissions Committee Call for Abstracts	The Mobile Source Emissions Committee is looking for papers on engine, fuel cell, and vehicle (e.g., tires, brakes) generated emissions. Areas of interest include emissions characterization, measurement, test development, simulation, and potential (future) regulations. Studies of exhaust from engines and fuel cells running conventional, renewable, and/or alternative fuels are welcome. Papers describing methods of controlling or reducing criteria pollutants, such as particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxides as well as hydrogen, ammonia, and aldehydes from mobile sources to meet current and future regulations will also be considered. An area of special interest is the optimization of criteria pollutant reduction with simultaneous reduction of greenhouse gases.
SDP100	Sustainable Development for Automotive Industry	This session focuses on sustainable development for automotive industry in the United States and other countries: Life-cycle Analysis; Vehicle Ownership Cost; Fuel Economy and Energy Saving; Vehicle Emission Containing; Use and End-of-Life; Circular Economy; Energy Policies; and Advances in Alternative Energy sources. New market focus will be on battery recycling.
PFL760	Life Cycle Analysis	Regulatory bodies and climate groups are calling for lower GHG emissions. However automotive emissions are assessed at the vehicle's tailpipe where no emissions are measured for battery electric and fuel cell electric vehicles. Despite this, emissions are generated during the vehicle's manufacturing and end-of-life phases as well as during fuel production. To properly quantify emissions reductions from electrified powertrains a life-cycle analysis, or cradle-to-grave, approach is required.

PFL410	Exhaust Emissions Control - New Developments	Papers are invited on novel approaches and/or unconventional modifications to emission controls for IC engines fueled by gasoline, diesel, biofuels or hydrogen. Topics include the integration of external heat or power sources and other interactions between engine and emission controls as well as uncommon solutions to reduce criteria pollutants. Reviews of future regulations and potential strategies to meet them including sensors and control systems will also be considered.
PFL420	Exhaust Emission Control Systems	Multiple sub-sessions cover the following exhaust emissions control topics: System integration and durability, advances in catalyst substrates, advances in particulate filter substrates, advances in NOx reduction technology, and on-board measurement and control.
PFL430	Emission Control Modeling	Papers are invited for mobile emissions control modeling, as well as their validation and application. Technologies covered include aftertreatment systems with injectors, heaters, filters and catalysts for both on-road and off-road power plants including, but not limited to internal combustion engines and hybrid electric platforms, fed by liquid fossil fuels and alternatives such as biofuels, gaseous fuels and hydrogen. Modeling aspects range from fundamental, 3-D thermal, fluid or reaction models of individual components to system level simulation, optimization, and control.
PFL440	Emissions Measurement and Testing	Sub-sessions cover emissions measuring techniques and testing regimes. This includes new analysis techniques and the novel application of existing techniques, the comparison of existing and proposed testing regimes with real world experience, including modeling.
PFL450	Particle Emissions and Control from Combustion Sources	The session kicks off with a study of combustion particles from sustainable diesel like fuels. The following papers cover the combustion particle emissions from diesel engines and their control with diesel particulate filters. Finally, two papers discuss the sub 23 nanometer particles and the challenges of meeting the EU VII particle number requirements.
Motorsports		
MSEC101	Strategic Engagement: Showcasing University Innovations in the Mobility Sector	This strategic oral presentation session is exclusively tailored for students actively involved in SAE Collegiate Design Series (CDS) competitions or other university projects/competitions like Formula SAE, Baja SAE, SAE Aero Design, and SAE Clean Snowmobile Challenge. Students will have the opportunity to present their essential Cost, Design, or Business presentations (or similar project reports) to industry professionals attending WCX (World Congress Experience). The primary objective of this session is to provide a platform for students to gain exposure and engage with leading mobility companies. The session will highlight innovative solutions, foster industry-academia collaboration, and offer a unique networking opportunity for future career prospects.
MSEC100	Motorsports Engineering	This session focusses on the links between motorsports, the mainstream automotive industry and academia. As such, it is the forum at the WCX where ideas and knowledge involving motorsports can be exchanged between the three communities. This exchange will be accomplished by the use of featured speakers from motorsports, and presentations, both written and oral, of topics deemed to be of relevant interest to the motorsports community in general, and to students and faculty involved in engineering education.
Vehicle Software and Hardware		
AE301	Foundations of Automobile Electronics: In-Vehicle Networks	Vehicle networks and communication protocols play a key role in meeting today's complex system requirements and product flexibility. This session will feature critical talks on in-vehicle networks followed by a panel discussion on system integration and testing challenges. Come prepared to ask questions of these experts.

AE302	Foundations of Automobile Electronics: Cybersecurity	This session focuses on cybersecurity for cyber-physical vehicle systems. Topics include: design, development and implementation of security-critical cyber-physical vehicle systems, cybersecurity design, development, and implementation strategies, analysis methodologies, process and life-cycle management, comparisons of system safety and cybersecurity, etc. Application areas include: security-critical automotive systems as well as other security-critical ground vehicle and aviation systems.
AE303	Foundations of Automobile Electronics: Electromagnetics and Antennas	Now-a-days use of electromagnetics in automotive system design involves engineering high performance and cost-effective antennas for communication, navigation, ADAS, RKE, TPMS, Infotainment, and wireless sensors for vehicle health monitoring while minimizing undesired effects. This session covers the development, analysis (including computer-based simulation methods), and testing of the intentional and unintentional electromagnetic environment of today's automotive systems.
AE305	Electrical Distribution Systems and Wiring Harnesses	The session covers electrical distribution systems (EDS) for low and high voltage applications. It includes the development and application of new materials and components, the physical and electrical protection of cables, system integrity and reliability, and the physical layer of databus systems. In scope are novel theoretical and practical applications of EDS and harnesses for road vehicles including design, development and validation, emerging standards and specifications and environmental aspects such as EMC and safety as they relate to the EDS.
AE800	Software Defined Vehicle	The session seeks to define what is a Software-Defined Vehicle and how it is being applied by OEMs and Tier Suppliers. We are seeking manuscripts and presentations that address Software-Defined Vehicle in the application of any vehicle that manages its operations, adds functionality, and enables new features primarily or entirely through software. Additional discussion being sought include how Software-Defined Vehicles are the next evolution of the automotive industry.
IOT100	Vehicle Internet of Things	The criticality of Vehicle Internet of Things (VIOT) has grown significantly with the advancement of ADAS, Avs and Smart Transportation technologies as well as new business models on connected consumer. The organizers of these sessions are looking for abstract submissions on the following areas: smart transportation, driverless transportation, route optimization, new and emerging technologies and business practices, vehicle data (big data) analytics and machine learning algorithms, and Edge Devices.
AE200	Automotive Embedded Software and Systems: Hardware and Software	This session is seeking submissions focusing on Design Optimization Techniques in Electronics, Model-Based Controls and Software Development, Verification and Validation of Embedded Software, Electronics Design – Processes, Optimization Techniques, Hardware Design, Systems Integration, Software / System Testing and Validation, Hardware Design Engineering and Development and Engine & Transmission Control. Abstracts featuring case studies, practical applications and Research and development project are requested.
PFL110	0-D and 1-D Modeling and Numerics	
PFL120	Multi-Dimensional Engine Modeling	The spectrum of papers solicited for this session reflect the truly multi-disciplinary nature of the field of Multi-Dimensional Engine Modeling. The session covers advances in the development and application of models and tools involved in multi-dimensional engine modeling. This includes advances in chemical kinetics, combustion and spray modeling, turbulence, heat transfer, mesh generation, and approaches targeting improved computational efficiency. Papers employing multi-dimensional modeling to gain a deeper understanding of processes related to turbulent transport, transient phenomena, and chemically reacting, two-phase flows are also encouraged.

PFL130	Control System Design, Calibration, and Optimization	This session focuses on powertrain control system design, calibration, and optimization.
PFL140	Engine Flows and Combustion Diagnostics	This session features papers that focus on extending and improving various sensors and diagnostic methods that can be employed to examine the flow and combustion processes in both production engines and research environments. Examples of diagnostics of interest include, but are not limited to: PIV, LIF, pressure sensors, ion probes, exhaust gas composition sensors, and various spectroscopic optical techniques.
PFL150	Powertrain Adaptation for Connectivity and Automation	This session will cover technologies that use connectivity and automation to optimize vehicle dynamics and powertrain systems operations, with the goal of reducing energy consumption. Contributions may include vehicle dynamics and powertrain control technologies, implemented on single vehicles or across a cohort of cooperating vehicles, showing potential to significantly improve individual vehicle energy efficiency. Concepts and technologies supported by experimental studies are welcome.
PFL170	High Efficiency IC Engines Concepts	This session focuses on technologies that have to potential for improving the efficiency of internal combustion engines such as advanced combustion, cooled EGR boosting, ignition and direct injection technologies, pressure boosting, intelligent combustion, thermal management, fully variable valvetrains, alternative or modified engine cycles, Variable Compression Ratio, and other new and developing technologies. Papers focused on waste heat recovery are located in sessions HX102 or HX103.
PFL180	Recent Developments in Propulsion Technologies for Ground Transportation	Technical presentation, review, and investigation on recent progress in general ground propulsion technologies, including powertrain technology roadmap, regulation review, product development and localization, off-road applications, new technology evaluation, decarbonization, and emission control. PFL 180 covers both conventional and alternative vehicle propulsion system technologies.
PFL740	Electric Motor & Power Electronics	Power electronics and electric motors are essential for improving vehicle efficiency through drivetrain electrification. Technologies that support high efficiency, high power density, and low cost motors and power modules are required for the success of vehicle electrification. (For Chargers and Charging Electronics Architecture/Design see AE600)
PFL750	Controls for Hybrids and Electric Powertrains	This session covers propulsion control processes related to achieving stringent market fuel economy, emissions, performance, reliability, and quality demands of hybrid and electric powertrains. Topics include the control, calibration, and diagnostics of the engine, powertrain, and supporting electromechanical subsystems related to energy management. (For Chargers and Charging Electronics Architecture/Design see AE600)
Vehicle Performance/Handling		
SS600	Steering and Suspension Technology Symposium	The purpose of this session is to provide a forum for presentations on suspension and steering related topics as it applies to ground vehicles. Papers for this session should address new approaches in the design, control, testing and simulation of suspension and steering systems, as well as integration of the aforementioned into drivers assistance and autonomous vehicle systems.
SS700	Tire and Wheel Technology	The aim of this session is to provide a forum to bring together researchers do discuss and disseminate the research on tire and wheel technology. Examples of topics to this session include (but are not limited to) nonlinear behavior of tires and wheels, static/dynamic stress analysis, nonlinear material modeling, contact stress, impact, noise, vibration, traction, hydroplaning, effect of tires on vehicle performance, rolling resistance, and durability.

SS800	Vehicle Aerodynamics- Open Call for Abstracts on all topics	The Vehicle Aerodynamics organizing committee is seeking abstracts for all aspects of Vehicle Aerodynamics including but not limiting to: CFD Methods, Commercial Vehicles, Experimental Technologies and Correlation, Wheels/Tires, Surface Contamination, Platooning/Vehicle Interaction as well as Aerodynamic Development and fundamentals.
SS900	Vehicle Dynamics	This session is focused on vehicle dynamics and controls using modeling and simulation, and experimental analysis of ICE, BEV and Hybrid passenger cars, heavy trucks, and wheeled military vehicles. This session addresses active and passive safety systems affecting the yaw, pitch and roll of the vehicle; driving simulators and hardware-in-the-loop systems; suspension kinematics and compliance; steering dynamics, advanced active suspension technologies; and tire force and moment mechanics.
SS901	Electric Vehicle Drivetrain Dynamics for in-wheel motors Application	This session deals with the analytical and experimental studies of vehicles with electric drives or any non-conventional concepts that stretch the vehicle dynamics/mobility performance using intelligent technologies such as in-wheel motors, torque-vectoring controls, multi-wheel steer-by-wire, etc.
SS902	Advanced Wheel Corner Concepts	The road mobility electrification and automatization for in wheel motors, together with novel sensor and actuator technologies, cause a paradigm shift towards new vehicle systems concepts. It concerns especially revisiting the chassis design in order to satisfy complex, interconnected requirements to safety, comfort, redundancy and user acceptance. Most of future chassis technologies, which are currently under development by automotive OEMs and suppliers, are targeting new wheel corner variants radically differing from conventional car configurations.