会议手册
EVENT GUIDE

SAE 2018
噪声与振动论坛
NOISE AND VIBRATION FORUM

2018 年 9 月 13 日 上海颖奕皇冠假日酒店
September 13, 2018, Crowne Plaza Shanghai Anting Golf, Shanghai, China

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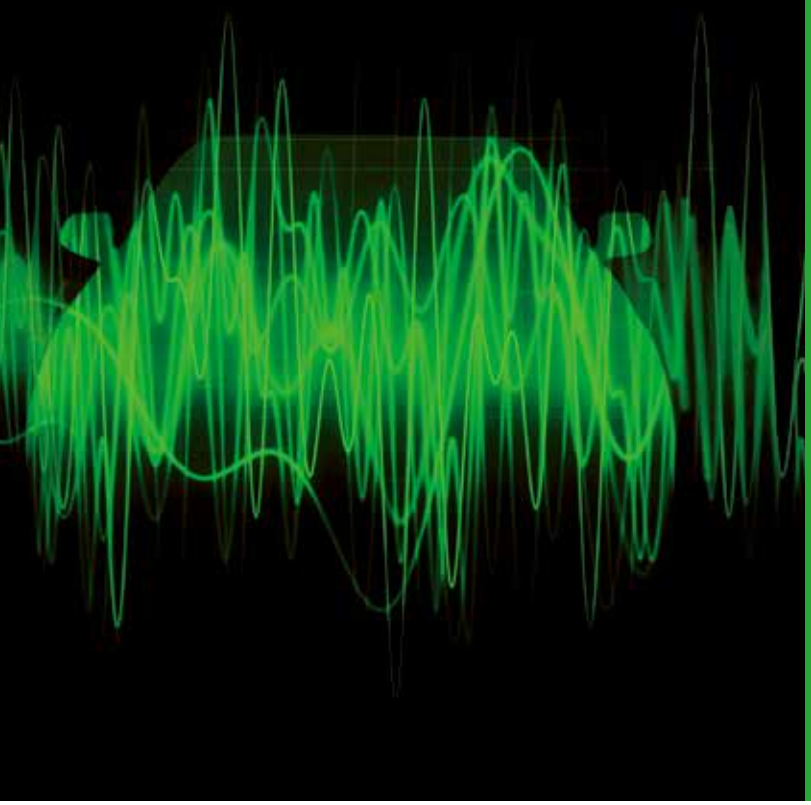

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SAE International 第一任副主席是一个名叫亨利 • 福特（美国福特汽车公司创始人）的才志兼备的工程师，在最早的发展阶段，SAE 就获得了奥维尔 • 莱特（飞机发明人之一）等人的支持。在此基础上，我们建立了一个紧密合作、信息互通的广泛的中立性平台，并制定了许多首创标准。今天，SAE 已经成为了全球公认最权威的航空、汽车、商用车及工程农用机械工程知识来源，而信息共享仍然是我们的基本原则。

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Through a comprehensive collection of programs, products and services, we supply the information, tools, and technical know-how to help today's professionals do their jobs better while we ensure the development of the next generation of mobility engineers.

Since 1905, SAE has connected automotive, aerospace, and commercial vehicle engineers to each other and the technical resources needed to foster a lifetime of learning, solutions to improved vehicle technology, and the advancement of the mobility industry.

SAE International—whose first vice president was an up-and-coming engineering talent by the name of Henry Ford and included early supporters like Orville Wright—was based on providing a platform for collaborative and informed dialog and the impetus of its earliest standardization efforts. Today, the sharing of information remains at its core, with SAE being acknowledged globally as the ultimate knowledge source for mobility engineering.

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9 月 13 日 · September 13

08:45	**欢迎致辞** Welcome Speech
09:00	**主旨演讲 - 噪声和振动工程的发展趋势** Keynote - NVH and Attributes Balancing on Electrical Vehicles
10:30	茶歇 Tea Break
11:00	**混合动力和电动汽车的道路噪声 NVH 考量** Road Noise NVH Considerations for Hybrid and Electric Vehicles
12:30	午餐 Lunch
14:00	**混合动力和电动汽车的道路噪声 NVH 考量** Road Noise NVH Considerations for Hybrid and Electric Vehicles
15:30	茶歇 Tea Break
16:00	**电驱动系统的变速器和传动系统噪声** Transmissions and Driveline Noise from Electric Drive Systems

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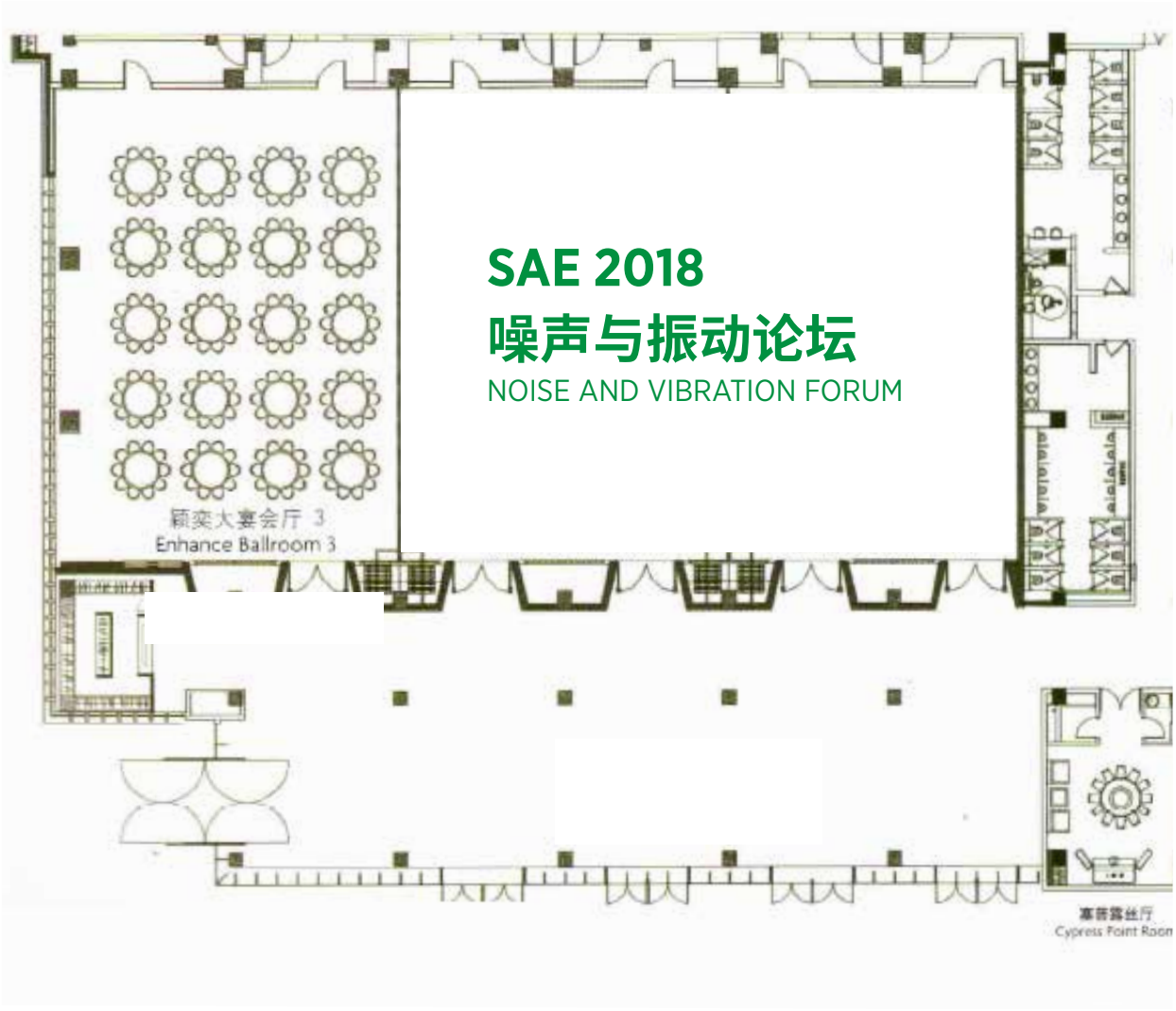


顾鹏云 博士
Dr. Pengyun GU

吉利汽车研究总院
首席 NVH 工程师、副院长

Chief NVH Engineer and Vice President
Geely Automobile Research Institute

庞 剑 博士
Dr. Jian PANG

长安汽车工程研究总院
副院长、总工程师

Vice President and Chief Engineer
Changan Auto Global R&D Centre

Pranab Saha 博士
Dr. Pranab Saha

Kolano and Saha Engineers 有限公司
联合创始人兼首席顾问

Co-founder and a Principal Consultant
Kolano and Saha Engineers, Inc.

万 泉 博士
Dr. Andy WAN

3M 中国
汽车与航天解决方案部门
NVH 专家

NVH expert at Automotive and
Aerospace Solutions Division
3M China Limited

STAFF TEAM 项目团队

James Sherman
Technical Program Developer
James.Sherman@sae.org

Melissa Jena
Project Manager
Melissa.Jena@sae.org

Nori Fought
Content Administrator
Nori.Fought@sae.org

Megan Mccoy
Event Sales Development Associate
Megan.Mccoy@sae.org

Alan AO
Manager, Events & Aerospace Standards, China
Alan.Ao@sae.org

Will CHANG
Marketing Program Manager, China
Will.Chang@sae.org

Rick WANG
Project Manager, China
Rick.Wang@sae.org

Yasmine MIAO
Event Sales Assistant, China
Yasmine.Miao@sae.org

SEPTEMBER 13

8:45 **Welcome Speech**
Billy XU General Manager, China - SAE International

KEYNOTE - TRENDS IN NOISE AND VIBRATION ENGINEERING

Moderator Dr. Pranab Saha

9:00 **NVH and Attributes Balancing on Electrical Vehicles**
Alexandre Nunes NIO

ABSTRACT

Engineering criteria and guidelines have been developed and consolidated over the years to develop a good car according to the target market and customer requirements. These receipts worked well with reasonably stable boundary conditions, linear forecast on requirement and customers' expectations. Moving to the future, looking into the electrification, increased on-board electronics, autonomous driving and connectivity, there will be somehow impact on users' perception and expectation.

While the whole future of mobility is clearly shifting, the need of a fundamental excellence in the dynamic experience is unchanged. There will always have the need for cabin comfort; quietness, temperature control, smooth ride, convenience and safety feeling. All at minimum energy cost. The expectation is indeed increasing.

The proposal of this presentation is to discuss the successful vehicle development under the perspective of new energy vehicles. It will be discussed the challenges on application of lightweight strategies, the increased demand on thermal integration and the impact on NVH, chassis and body platform, structural integration, software integration and others. It will also be presented the methodologies, test and simulations available to support a good architecture and conscious balance of NVH and vehicle attributes.

9:30 **The Importance of Tire/Road Noise Mitigation for Electric Vehicles**
Gregory Goetchius Lucid Motors

ABSTRACT

This presentation will provide insight into the acoustical unmasking of road noise due to the absence of internal combustion engine noise, and will focus on both conventional and non-conventional strategies to reduce road noise in electric vehicles (EVs).

With EVs, the absence of noise and vibration generated by an internal combustion engine results in tire/road noise emerging as the dominant noise inside the cabin. While reducing road noise in automobiles has always been a high priority, the advent of EVs has arguably raised it to the number one priority for any EV development program. Like engine and drivetrain noise, road noise is complex and crosses over multiple large systems of the automobile, specifically the suspension, body structure and interior. Strategies for achieving acceptable levels of both structure borne and airborne tire/road noise will be discussed keeping these complex interactions in mind.

Conventional road noise mitigation strategies focus on the complex interactions noted above, and excellent results can be achieved by following these strategies. However, given the dominance of road noise in the cabin with a typical EV, it can be argued that conventional strategies are not adequate to provide the level of comfort required by EV customers, especially for those in the "Luxury EV" segment. In this case, applying active noise cancelation becomes a viable strategy and is now possible given the state of the art of the technology. This presentation will discuss the potential application of active noise cancelation specifically to the structure borne component of tire road noise.

For an organization that is making the transition from ICE vehicle development to EV development, the argument can be made that the bulk of the resources previously applied to engine/drivetrain noise can be redirected to tire/road noise.

10:00 **Challenges and Opportunities for NVH Performance Development in Electric Vehicles**
Jennifer Goforth General Motors

ABSTRACT

People want cleaner air to protect their health and preserve our planet for future generations. This explains why today's vehicles are more efficient and why more people are embracing environmentally friendly options. As the automotive industry transforms itself, new technologies and the evolving demands of consumers are bringing fundamental changes to how automakers design and build vehicles. With the belief in an all-electric, zero emissions future, GM is well on its way to bringing at least 20 new all-electric models to the market by 2023. It's foreseeable that sales of new energy vehicles will increase across the industry, especially with government policy support. As a result, more and more consumers will travel in electric vehicles. NVH performance in electric vehicles poses unique challenges than those powered by traditional internal combustion engines, as the noise from pumps, compressors, fans, etc. suddenly become very noticeable without the masking noise of standard powertrains. This brings both new challenges and opportunities to NVH engineers.

10:30 Tea Break

9 月 13 日

8:45 **欢迎致辞**

徐秉良 SAE International 中国区总经理

主旨演讲 - 噪声和振动工程的发展趋势

主持人 Pranab Saha 博士

9:00 **平衡电动车的 NVH 与品质**

Alexandre Nunes 蔚来汽车

摘要

为了满足目标市场和客户的汽车要求，工程标准和指导方针在近年来不断得到发展和巩固。这些标准和方针适用于比较稳定的边界条件、需求的线性预测和客户预期。在未来，随着电气化发展、车载电子产品的增加以及自动驾驶和互联汽车的发展，用户的感知和预期也将在某种程度上受到影响。尽管交通出行方式在未来将发生明显的变化，但用户仍将对驾驶体验提出较高的要求，比如在提高舒适性、安全性、温度控制、驾驶平稳性、便捷性和安全性的同时在最大程度上降低能耗。总之，用户的期望确实在不断上升。

本次演讲将从新能源汽车的角度出发，探讨汽车研发的成功案例。内容将包括轻量化策略应用面临的挑战、热集成需求的增加以及 NVH、底盘和车身平台、结构集成、软件集成等受到的影响。课程还将介绍用于打造良好架构，平衡 NVH 和汽车属性的方法、测试和模拟。

9:30 **轮胎、道路噪声缓解对电动汽车的重要性**

Gregory Goetchius Lucid Motors

摘要

本次演讲将介绍因内燃机噪声减少引起的道路噪声增加的问题以及减少电动汽车（EV）道路噪声的传统和非传统方法。

和传统汽车的内燃机不同，电动汽车的发动机不会引起噪声和振动。因此，电动汽车车厢内的主要噪声其实来自于轮胎或路面。尽管减少汽车的道路噪声一直是亟待解决的问题，但随着电动汽车的出现，这个问题成为了任何电动汽车发展项目都迫切需要解决的首要问题。和发动机和传动噪声一样，道路噪声是个复杂的问题，并且涉及到了汽车的悬架、车身结构和内饰等多个大型汽车系统。本课程将结合这一复杂问题来讨论如何使结构和空传轮胎 / 道路噪声达到可接受的水平。

传统的道路噪声减少方法主要关注上述提到的一些问题，并且可以很好地解决这些问题。但是，考虑到道路噪声是传统电动汽车车厢内的主要问题，因此，传统的方法可能无法满足电动汽车，尤其是“豪华型电动汽车”用户的乘坐舒适性要求。在新技术的助力下，“有源噪声消除”方法应运而生，有望取代传统方法。本次课程将探讨有源噪声消除法在轮胎道路结构传递噪声分量中的应用潜力。

对于任何一个正在从 ICE 汽车研发过渡到电动汽车研发的组织来说，先前在发动机 / 传动噪声上投入的大量资源都可以转而用于解决轮胎 / 道路噪声问题。

10:00 **电动汽车 NVH 性能发展的挑战与机遇**

Jennifer Goforth 通用汽车

摘要

人们想要洁净的空气，既是为了保护自身健康，也是为下一代保护我们的地球。这也就是为什么如今汽车越发高能效、消费者越发青睐新能源汽车的原因。在汽车行业转型之际，面临科技的变革和消费者需求的变迁，汽车生产商设计制造车辆的理念与方式发生了根本改变。纯电动、零排放是汽车行业的未来，本着这一理念，通用汽车已开始着手打造至少 20 款全新纯电动车型，并计划于 2023 年推向市场。可以预见，新能源汽车的销量将全面上升，特别是在政府政策的推动下。越来越多的消费者将选择驾驶电动汽车出行。相较传统的以内燃机为驱动的汽车，NVH 性能给电动汽车的研发带来了一系列独特的挑战，失去了传统动力系统轰鸣声的遮掩，泵机、压缩机、风扇等汽车零部件产生的噪音会变得十分明显。对于 NVH 工程师而言，这是全新的挑战，也是全新的机遇。

10:30 茶歇

ROAD NOISE NVH CONSIDERATIONS FOR HYBRID AND ELECTRIC VEHICLES

Moderator Dr. Jian PANG

11:00

Acoustically Absorbing Lightweight Thermoplastic Honeycomb

Dr. Zhiming LUO Aearo Technologies LLC

ABSTRACT

The aerospace industry has employed sandwich composite panels (stiff skins and lightweight cores) for over fifty years. It is a very efficient structure for rigidity per unit weight. For the automobile industry, we have developed novel thermoplastic composite panels that may be heated and shaped by compression molding or thermoforming with cycle times commensurate with automotive manufacturing line build rates. These panels are also readily recycled at the end of their service life. As vehicles become lighter to meet carbon dioxide emission targets, it becomes more challenging to maintain the same level of quietness in the vehicle interior.

11:30

Acoustic Materials and Treatments for Electric Vehicles

Jian PAN Autoneum North America Inc.

ABSTRACT

The automotive industry is undergoing a transformation towards electrification. New and traditional vehicle manufacturers are bringing more and more electric vehicles to market. Noise control for electric vehicles poses unique challenges and demands different considerations for design and selection of acoustic materials.

Contrary to intuition, the absence of internal combustion engine (ICE) does not make acoustic treatments for electric vehicles easier. The sound signature of an electric vehicle can be characterized by multiple high-frequency tonal noise emitted from electric motor(s) and drivetrain mixed with broadband road and wind noise. The high frequency tonal noise is prominent during acceleration, deceleration and braking, while broadband road noise and wind noise dominate when driving on rough road and/or at high speed.

A variety of EV noise control strategies have been adopted by vehicle manufacturers. Acoustic components made of fibrous materials and polyurethane foam are used to absorb noise, while mass based components have been developed to reduce noise transmission into the passenger compartment. The frequency contents of the tonal noise, vehicle architecture and packaging of the noise generating electric components must be taken into account when designing and developing acoustic treatments for electric vehicles. In addition, successful noise control strategy must consider weight impact of such a solution.

This presentation will systematically discuss electric vehicle noise sources, frequency contents, vehicle architecture, acoustic material design and selection to reduce electric vehicle noise.

12:00

The Challenge of Road Noise Control in Electric Vehicle Development

Dr. Greg CHEN Geely

ABSTRACT

New energy vehicles are becoming more and more popular thanks to the government policies, the advancement of the technology, and the proliferation of electric car charging stations, the improvement in quality and price point as well as more people are environmentally conscious among others.

Electric cars will be come the main stream of passenger vehicles. The NVH challenges that the electric vehicles bring along are for real. And road noise in electric vehicles is one of the most critical issues. This talk is a discussion on road noise control in electric vehicle development in the following areas:

1. The difference/indifference in electric cars and conventional car road noise
2. The road noise consideration in body structure development
3. Wheel and chassis
4. Active noise cancellation application

LUNCH

混合动力和电动汽车的道路噪声 NVH 考量

主持人 庞 剑 博士

11:00

吸音轻质热塑性蜂窝板

Zhiming LUO 博士 Aearo Technologies LLC

摘要

航空航天工业采用夹层复合板（硬皮板和轻质芯板）已经有五十多年的历史了。对于每单位重量刚度来说，这是一个非常有效的结构。而在汽车行业，我们研发了一种可以采用压缩成型或热成型的方法进行加工的新型热塑性复合板。这种复合板的周期时间不仅和汽车生产线建造率保持一致，还可以在使用寿命结束时进行回收。随着汽车为满足二氧化碳排放要求而不断实现轻量化发展，要使汽车内部保持同样水平的安静环境变得越来越具有挑战性。

11:30

电动汽车声学材料及处理

Jian PAN Autoneum 北美

摘要

汽车行业正在经历电气化变革，无论是新兴的还是传统的汽车制造商都在开发电动汽车。电动汽车的噪音控制有其独特的难点，因此声学材料的设计与选择也与传统汽车不同。

与人们的直觉相反，缺少内燃机并不意味着降低了电动汽车声学工艺的难度。电动汽车的声音特征可总结为两部分：由电机和传动系发出的多种高频音调噪音，以及宽频路噪与风噪。高频音调噪音主要出现在加速、减速和制动阶段，而宽频路噪和风噪主要在路面粗糙及高速行驶的情况下出现。

汽车制造商已经采用了多种电动汽车降噪措施，例如使用纤维材料和泡沫聚氨酯制成的声学部件来吸收噪音，以及使用新开发的块状部件来减少传入车厢的噪音。在设计和开发电动汽车的声学性能时，必须将音调噪音的频率成分、汽车架构、以及发出噪音的电动部件的封装考虑在内。此外，成功的噪音控制策略还必须考虑到整个方案产生的重量。

本次演讲将系统地讨论电动汽车的噪音来源、频率成分、汽车架构、以及如何设计并选择声学材料以实现降噪。

12:00

新能源汽车发展过程中对道路噪声控制挑战

陈志东 博士 吉利汽车

摘要

在政府政策、技术进步和电动汽车充电站大幅增加的影响下，新能源汽车变得越来越普及。此外，新能源汽车的质量和价格的提高以及人们环保意识的增加也是新能源汽车发展的主要原因。

电动汽车将成为乘用车的主流。然而，电动汽车的发展面临着 NVH 方面的挑战。此外，电动汽车中的道路噪声也是亟待解决的关键问题。本课程就以下几个方面对道路噪声的控制进行探讨：

1. 电动汽车和传统汽车道路噪声的差别 / 无差别
2. 车身结构开发中的道路噪声问题
3. 车轮和底盘
4. 有源消声技术和应用

午餐

ROAD NOISE NVH CONSIDERATIONS FOR HYBRID AND ELECTRIC VEHICLES (CONTINUED)

Moderator Dr. Andy WAN

14:00	**Aeroacoustic Sources of Noise for New Energy Vehicles** **Dr. Robert Powell** Dassault Systèmes SIMULIA **ABSTRACT** Electric vehicles are expected to be especially quiet. While this may be true for certain "idle" and acceleration events at low speeds, such vehicles are subject to much the same road and wind noise excitations at cruising conditions as are conventionally-powered vehicles. Without masking noise from the internal combustion engine, noise from the HVAC system is more prominent at low speeds. With powertrain electrification, and increasing use of autonomous driving features, thermal management of electronic components and batteries is critical, bringing along additional noise from cooling fan operation that can startle passengers and bystanders when unexpectedly cycling on and off. These disconnects between expectations and reality put great pressure on designers of new energy vehicles to reduce unwanted noises, avoiding customer dissatisfaction and possible loss of future sales. Managing the transient flow of air throughout the vehicle operating range is essential for designers to control wind noise, HVAC noise and other cooling fan noises. This presentation will illustrate how engineers can use modern simulation tools to reduce aeroacoustic sources, leading to fewer launch delays and better customer satisfaction.
14:30	**Strategy of Road Noise Control for Hybrid and Electric Vehicles** **Dr. Jian Pang** Changan Auto Global R&D Center **ABSTRACT** Road noise becomes prominent interior noise for electric vehicles and for hybrid vehicles at EV modes in the absence of engine noise. Road noise significantly influences the vehicle sound quality, so today, it is extremely important to develop control strategy of road noise in order to reach satisfied NVH performance. The report divides the road noise into airborne road noise and structural-borne road noise. Near-field noise generated by interaction between road and tire and transferred into vehicle interior through body is called the airborne road noise. The tire vibration induced by the road is transferred to suspension and then to the body, and the vibrated body radiates sound to the interior, forming the structural-born noise. The road noise performances are different for the same vehicle on different roads and/or at different driving speeds. The vehicle road noise is a combination of the airborne and structural-borne noise. The airborne noise dominates the interior noise from middle to high frequency, especially around 1000Hz, while the structural-borne noise dominates low frequency, especially below 100Hz, and some middle frequency interior noise, especially driving on rough or coarse roads. The strategy to control the road noise can be processed from interaction between the road and the tire, and modal decoupling of adjacent systems. The near-field noise is mainly determined by the tire tread pattern and groove structures. The near-field noise includes pumping noise, piping noise, resonant noise, etc. The airborne road noise can be controlled by optimizing the tire tread and body sound package. The coupling between the tire and the suspension and the coupling between the suspension and the body will worsen the structural-borne noise, so the mode decoupling principle should be applied for the tire, suspension and body. The cavity noise induced by the coupling between the tire cavity and the suspension is a special structural-borne noise, which can be reduced by using cavity resonator, suspension damper, etc. The vibration transmission through the suspension should be effectively controlled, especially the isolation effect of the bushings. The body sensitivities are critical for the structural-borne road noise control. The body panel vibration and sound radiation are the key reasons for the low frequency booming. So, the body frames and panels must be stiffened enough in order to attenuate the structural-borne road noise. The road noise is transferred into the interior by different airborne and structural-borne paths. The contribution for each path and at each frequency can be identified in order to find some particularly frequency noise problem.
15:00	**Interior Noise Contribution Analysis of New Energy Vehicle Based on SEA Modeling** **Dr. Xiujie TIAN** Gissing Tech **ABSTRACT** Sound package components have a great impact on the acoustic performance in the vehicle. New energy vehicle (HEV/EV) has a totally different noise condition compare to ICE vehicle. Based on these, we try to analyze the relationship between the transmission loss of sound package components and sound pressure level of the HEV vehicle. Vehicle SEA model that met certain accuracy was built based on a real HEV vehicle. Contribution analysis of the reintegrated SEA model was carried out to identify significant components.
15:30	Tea Break

混合动力和电动汽车的道路噪声 NVH 考量（续）

主持人 万 泉 博士

14:00	**新能源汽车的空气声噪声源** **Robert Powell 博士** Simulia 软件公司 **摘要** 人们对于电动汽车的印象是电动汽车非常安静。但事实上，只有在电动汽车处于怠速或者低速加速的状态下才能称得上如此。巡航状态下，电动汽车产生的路面摩擦声或是风声和传统动力汽车不相上下。而且，少了内燃机轰鸣声的掩盖，电动汽车 HVAC 系统产生的噪音在低速状态下更为明显。在汽车动力系统转向电力驱动的过程中，汽车自动驾驶功能也越来越普及，这就使得汽车电子元件和车载电池的温度控制变得至关重要。但同时，冷却风扇突然运转或者突然停下产生的额外噪音会惊扰到乘客和路人。人们对电动汽车的预期和现实之间的落差促使新能源汽车的设计者进一步思考降低噪音的方法，避免让消费者失望、影响车辆销售。控制好在车身内转瞬而过的空气流是设计师控制风声、HVAC 噪声和其他冷却风扇噪声的关键。此次演讲将演示工程师可以如何利用现代模拟软件工具降低空气声源，进而减少启动延迟，提升客户满意度。
14:30	**混动与电动汽车道路噪声控制战略** **庞 剑 博士** 长安汽车工程研究总院 **摘要** 没有了发动机噪声的掩盖，道路噪声成为电动汽车和混合动力汽车的主要车内噪声。道路噪声会在很大程度上影响汽车的声音质量。因此，研究控制道路噪声的方法，使 NVH 性能达到令人满意的程度是当务之急。 本演讲介绍了空气传播和结构传播这两种道路噪声。由道路和轮胎摩擦产生并通过车身传播到车内的近场噪声称为空气传播噪声。由道路引起的轮胎振动依次传播到悬架和车身，使车身振动，且振动声波由声源向四周传播到车内所产生的噪声称为结构传播噪声。 同一辆车的道路噪声性能在不同的道路上和不同的驾驶速度中也是不同的。汽车道路噪声既通过空气又通过结构传播。车内的空气传播噪声主要是中高频噪声，大概在 1000Hz 左右，而结构传播噪声则主要是低频噪声，一般低于 100Hz。一些中频的车内噪声会在汽车行驶在凹凸不平的道路上出现。 可以从解决道路和轮胎的摩擦或者相邻系统的模态解耦入手来控制道路噪声。 近场噪声主要由轮胎胎面花纹和沟槽结构决定。近场噪声包括泵送噪声、管道噪声和共振噪声等。可以通过对轮胎胎面和车身声学包装车进行优化来控制空气传播道路噪声。 轮胎与悬架之间的耦合以及悬架与车身之间的耦合将加剧结构传播噪声的问题。因此，轮胎、悬架和车身均应采用模态解耦原理。由轮胎空腔和悬架之间的耦合引起的空腔噪声是一种特殊的结构传播噪声，可使用空腔谐振器和悬架减振器等来减少这种噪声，还可通过提高轴衬隔离效果等方法来有效控制悬架的振动传递。 车身灵敏度是控制结构噪声控制的关键。车身板振动和声辐射是出现低频轰鸣的主要原因。因此，车身骨架和面板必须要足够坚实才能减少结构传播噪声。 道路噪声通过空气和结构这两种不同的传播方式传播到车内。了解这两种方式的噪声贡献度和频率大小可以帮助我们发现一些特殊的频率噪声问题。
15:00	**基于 SEA 建模的新能源汽车车内噪声贡献分析** **田秀杰 博士** 无锡吉兴汽车声学部件科技有限公司 **摘要** 声学包装元件会对汽车声学的性能产生很大的影响。和 ICE 汽车相比，新能源汽车（HEV/EV）有着完全不同的噪声条件。在此基础上，我们尝试分析了混合动力汽车的声学包装元件的传输损耗和声压级之间的关系，然后参考一辆混合动力实车建立了达到一定精度要求的 SEA 汽车模型。为了识别重要元件，我们还对重新整合的 SEA 模型的贡献度进行了分析。
15:30	茶歇

ROAD NOISE NVH CONSIDERATIONS FOR HYBRID AND ELECTRIC VEHICLES (CONTINUED)

Moderator Dr. Pranab Saha

16:00

Addressing NVH Challenges from E-Axle Development

Wei DU AVL List Technical Center Shanghai Co., Ltd.

ABSTRACT

This presentation first introduces current electric drive topologies available in the market. Even if the hybrid topologies would be still the transition choice in following years, the e-Axle is selected as specific example to highlight the NVH challenges of all electric drives. Main challenges like e-motor electromagnetic and mechanical noise, inverter tonal noise and transmission gear whine will be discussed.

The presentation will be separated into three main parts. Benchmarking and target setting for e-Axles, e-drive NVH simulation and optimization and gear whine optimization.

The first part focuses on AVL standard procedure for hybrid vehicles benchmarking, and illustrate AVL sound quality analysis based on real test data of new energy vehicles.

The second part, is dedicated to e-motor simulation model development, model tuning and e-motor design parameters optimization for improved NVH performance. Also correlation of inverter output current between Simulink model and real current measurement as well as e-motor housing modal comparison between simulation and test will be presented. Based on tuned e-motor model, AVL use AVL CAMEO to perform automation supported improvement by DoE analysis to achieve optimized design parameters for better NVH performance without degradation of torque and loss.

In the third part, the gear whine simulation topic will be addressed. Specifically, torque from e-motor simulation is applied into AVL Excite transmission model to calculate surface vibration of the transmission case. Combining the result with vibrations caused by electromagnetic forces, the overall surface vibration can be evaluated in simulation.

Finally the presentation will summarize all results and give an outlook to apply the shown solutions into future NVH developments.

16:30

Systems Engineering Approach for NVH Development of Electric Drivelines

Haitao GAO ZF Friedrichshafen AG

ABSTRACT

Systems engineering of NVH development ensures that all related components in the system are considered, and integrated into a whole. Especially for the acoustics of electric drive systems, due to the wide range frequency excitation and the unique excitation mechanism of the electric motor transmission. This presentation provides the approach of NVH development for the electric motor transmission, and the isolation systems. The analytical techniques are mainly based on acoustic transfer function calculation and measurement data. At its core, systems engineering utilizes the way of systems thinking to find the best NVH solution.

17:00

NVH Considerations for Electrified Powertrains

Dr. Kiran Govindswamy FEV North America Inc.

ABSTRACT

The automotive industry continues to develop new technologies aimed at reducing overall vehicle level fuel consumption. Powertrain and driveline related technologies will play a key role in helping OEMs meet fleet CO2 reduction targets for 2025 and beyond. Specifically, use of technologies such as downsized engines, idle start-stop systems, aggressive torque converter lock-up schedules, wide-ratio spread transmissions, and electrified propulsion systems are vital towards meeting aggressive fuel economy targets. Many of the technologies needed for meeting the fuel economy and CO2 targets come with unique NVH challenges. In order to ensure customer acceptance of new vehicles, it is imperative that these NVH challenges be understood and solved.

This presentation will begin with an introduction to the types of hybrid and electrified powertrain systems. Following this, an outline of different electrified driveline architectures will be discussed.

- Key NVH issues associated with integration of electrified drivelines into vehicles will be presented.
- The influence of key sub-systems on the NVH performance of the hybrid/electric vehicles will be illustrated.
- Examples of component-level and system-level NVH countermeasures will be discussed.
- Finally, the use of advanced test and simulation-based methodologies for smooth NVH refinement of future propulsion systems will be illustrated using case study examples.

混合动力和电动汽车的道路噪声 NVH 考量（续）

主持人 Pranab Saha 博士

16:00

E-Axle 电动轴发展所带来的 NVH 挑战

Wei DU AVL STC 公司

摘要

本演讲将首先介绍目前市场上的电力传动拓扑结构。混合型拓扑结构在今后几年中将仍是首选的过渡选择。即便如此，本演讲还是以 e-Axle 电动轴为例来介绍所有电力驱动面临的 NVH 挑战。演讲还将介绍电动马达电磁和机械噪声、逆变器音调噪声和传动装置噪声等主要挑战。

演讲包括 e-Axle 电动轴的基准和目标设定、e-drive 电力驱动的 NVH 仿真与优化以及传动装置噪声优化这三个部分。

第一部分将主要介绍混合动力汽车基准测试的 AVL 标准流程以及基于新能源汽车实际测试数据的 AVL 音质分析。

第二部分主要介绍旨在改善 NVH 性能的电机仿真模型的开发、模型校正和电动机设计参数优化。演讲还将介绍 Simulink 模型与实际电流测量的逆变器输出电流的相关性以及电动马达壳体模型的仿真与测试的比较。在调谐电动马达模型的基础上，AVL 使用 AVL CAMEO 并通过 DoE 分析来实现自动化支持改进，以便获得更好的设计参数，从而在无转矩衰减和损耗的情况下获得更好的 NVH 性能。

第三部分主要介绍传动装置噪声。具体地说，电动马达仿真的转矩将被应用于 AVL Excite 传输模型中，用来计算变速箱壳体的表面振动。通过将计算结果与由电磁力引起的振动结合，我们可以在仿真中评估出整体的表面振动。演讲最后还将总结所有的结果并展望一些现有的解决方案在未来 NVH 开发中的应用。

16:30

电动传动系统 NVH 开发的系统工程方法

高海涛 采埃孚

摘要

NVH 开发的系统工程旨在确保系统中的所有相关组件都被考虑在内并整合成为一个整体。这对于电力传动系统的声学发展而言尤为如此，因为电机传动装置采用了宽范围频率激励和独特的激励机制。本课程将介绍电机传动装置的 NVH 开发方法和隔离系统，并在声传递函数计算与测量数据的基础上进行分析。从本质而言，系统工程在探索最佳 NVH 解决方案的过程中使用的是系统思考方式。

17:00

电气化动力总成的 NVH 考量

Kiran Govindswamy 博士 FEV 北美

摘要

汽车工业的新技术仍在不断发展，旨在降低整车水平的燃油消耗。动力系统和传动系统的相关技术将在帮助 OEM 达到汽车大客户销售制定的 2025 年及以后的二氧化碳减排目标的过程中发挥关键的作用。具体地说，使用诸如小型发动机、怠速启停系统、紧凑的液力变矩器锁定计划、宽比扩展变速箱和电气化推进系统等技术对于满足紧迫的燃油经济目标而言至关重要。然而，用来实现燃油经济性和二氧化碳目标所需的许多技术都面临着 NVH 带来的挑战。为了确保客户接受新车型，我们就必须要了解和解决这些 NVH 挑战。

本演讲将首先介绍混合动力和电气化动力系统的几种类型。随后，演讲将讨论不同电气化传动系统结构的要点。演讲内容还将包括：

- 与电气化传动系统集成相关的关键 NVH 问题
- 关键子系统对混合动力 / 电动汽车的 NVH 性能带来的影响
- 有关组件级别和系统级别 NVH 对策的例子
- 结合相关案例介绍如何使用基于先进测试和仿真的方法顺利地使未来的推进系统实现 NVH 细化目标

Alexandre Nunes

蔚来汽车
车辆属性副总监

Alexandre Nunes 是蔚来汽车公司汽车属性部门副总监，负责 NVH、汽车动力、空气动力学、热性能、紧密性、能量、动力体验与耐久性等汽车特性的研究。

他持有物理学士学位与声学硕士学位，并在噪音与振动方面具备 25 年的工作经验。最初他研究的是乐器和汽车的声音质量，随后对音响体验开展了更深入的研究。

他曾在通用汽车公司工作 18 年，工作主要集中在 NVH 和汽车性能方面。其中他曾于 1997 年参与建设通用汽车巴西 NVH 实验室，这也是当时南半球最大的同类实验室。此外，他还于 2006 年设计并主持运营了泛亚汽车 NVH 实验室，包括 NVH 团队的招募和培训。他还撰写过汽车 NVH 的出版物，并参与相关技术论坛。

Alexandre 曾在多个地区发起并领导 30 多个汽车项目。自 2010 年起，他的工作范围扩展至整体汽车性能与平衡，以期深入理解当地消费者的要求、汽车架构和市场推动因素。

他于 2014 年搬至中国，从事电动汽车工作。2015 年加入蔚来汽车，负责开发公司第一款车型 ES8 的各性能。

Alexandre Nunes

Associated Director for Vehicle Attributes
NIO

Alexandre Nunes is Associated Director for Vehicle Attributes at NIO. Responsible for NVH, Vehicle Dynamics, Aero, Thermal, Tightness, Energy, Dynamic Experience and Durability.

He has Bachelor's Degree in Physics, Master's Degree on Acoustics and working with Noise & Vibration for 25 years. His motivation started with sound quality studies on musical instruments and cars looking for a deeper understanding of sound experience.

He worked 18 years for General Motors, mostly inside NVH and Vehicle Performance. During this period, Alexandre supported the construction of GM Brazil NVH lab in 1997, biggest Lab in South Hemisphere at the time. Also, designed and implemented PATAC NVH Lab in 2006, including recruiting and training of NVH team. He's being engaged in publications and technical forums to promote NVH in Automotive.

Alexandre has developed and launched over 30 vehicle projects for several global markets. Since 2010, his work scope expanded to overall vehicle performance and balance, looking into deeper understanding of regional customer requirements, vehicle architecture and enablers.

Moved to China in 2014 to work in Electric vehicles. Alexandre joined NIO in 2015 and led the Performance Attributes of NIO first vehicle, ES8.

Gregory Goetchius

Lucid Motors
NVH 工程经理

Greg 在汽车 NVH 领域拥有 30 年的工作经验，曾在克莱斯勒 / 戴姆勒 - 克莱斯勒公司（现改名为 FCA 公司）、材料科学公司（Material Sciences Corporation）、特斯拉汽车公司（Tesla Motors）工作。目前，他在 Lucid Motors 公司任职。

Greg 目前是 Lucid Motors 的 NVH 工程经理，主要负责 Lucid Air 高级电动车的 NVH 研发工作。他还是 Lucid Air 音频系统的工程负责人。

1997 年，他成为了 SAE 会员。1999 年，他进入了 SAE 噪声与振动会议组委会。2015 年，他获得 SAE 的 Forest R McFarland 奖。

Gregory Goetchius

Engineering Manager, NVH
Lucid Motors

Greg has worked in the automotive NVH field for 30 years, spanning positions at Chrysler / DaimlerChrysler (now FCA), Material Sciences Corporation, Tesla Motors and most recently at Lucid Motors.

Greg is currently the NVH Engineering Manager at Lucid Motors and is responsible for the NVH development of the Lucid Air premium electric vehicle. In addition, he has system engineering responsibility for the audio system of the Lucid Air.

Greg has been an SAE member since 1997 and has been on the Organizing Committee of the SAE Noise and Vibration Conference since 1999, serving as General Chair in 2009. In 2015, he received SAE's Forest R McFarland Award.

Jennifer Goforth

通用汽车
全球电动汽车项目中国区电气化首席工程师

2016 年 11 月，Jennifer Goforth 被通用汽车任命为中国电气化首席工程师，负责为中国市场研发电气化车辆。

1998 年，她开始在通用汽车土星（Saturn）分部工作，担任底盘及动力总成高级制造工程师。一年后，她首次被派往国外工作，负责 Opel ITDC 的底盘及动力总成产品研发工作。在土星分部、欧宝公司和通用汽车先后担任了制造、生产和工程方面的职务后，她被提升为 Spark EV 的汽车产品线主管。

在过去 10 年中，Goforth 曾担任过包括通用汽车韩国分公司的首席工程师在内的多项工程方面的职务，致力于推动通用汽车电气化战略的发展。

在担任现有职务之前，Goforth 曾是 Global Accessories 的主管，负责通用汽车售后配件研发的工程和项目管理工作。

Goforth 拥有马凯特大学的机械工程学士学位以及普渡大学的工程硕士学位。

Jennifer Goforth

Chief Engineer, China Electrification GM Global Electric Vehicle Programs
General Motors

Jennifer Goforth was appointed chief engineer of China Electrification in November 2016 by General Motors. In the newly created role, she is responsible for electrified vehicles developed for the Chinese market.

She began her GM career in 1998 at the Saturn division as an advanced manufacturing engineer for chassis and powertrain. A year later, Goforth accepted her first international assignment at Opel ITDC on the chassis and powertrain product development team. After rotating through several manufacturing, production and engineering positions of increasing responsibility at Saturn, Opel and GM, she was promoted to vehicle line director for the Spark EV.

Over the past 10 years, Goforth has held multiple engineering assignments supporting GM's electrification strategy, including chief engineer for the Chevrolet Bolt EV at GM Korea.

Prior to taking on her current assignment, Goforth was director of Global Accessories, where she oversaw engineering and program management for the development of GM's aftermarket accessories.

Goforth has a bachelor's degree in mechanical engineering from Marquette University and a master's degree in engineering from Purdue University.

Zhiming LUO 博士

Aearo Technologies LLC
航空产业系统工程经理

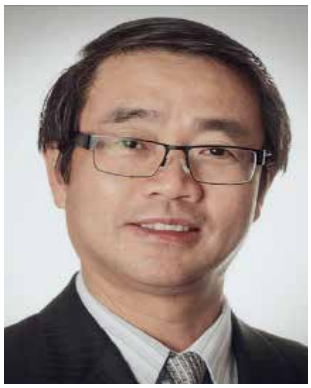
Zhiming Luo 目前在 3M 旗下的 Aearo Technologies LLC 公司担任航空航天业务的系统工程经理，负责监督航空航天市场的 NTI 和 NPI 项目和应用。Luo 博士的专长领域主要为噪声、振动、结构动力学和传热。在过去的 20 多年中，Luo 博士始终致力于为汽车、商用卡车和航空航天工业研究和开发热声隔绝方面的新材料、产品、技术和系统解决方案并推动其商业化发展和实际应用。

Dr. Zhiming LUO

System Engineering Manager for Aerospace Business
Aearo Technologies LLC

Dr. Zhiming Luo is currently the System Engineering Manager for aerospace business at Aearo Technologies LLC, a 3M Company, overseeing NTI and NPI projects and applications for aerospace market. Dr. Luo's technical expertise lies in the areas of noise, vibration, structural dynamics, and heat transfer. Dr. Luo has more than 20 years of experience in research, development, commercialization, and application of thermal acoustic insulation including new materials, products, technologies, and system solutions for automotive, commercial truck, and aerospace industry. He received his Ph.D. from Northwestern Polytechnical University, China and accomplished postdoctoral fellowship at University of Michigan.

Jian PAN



Autoneum 北美
系统开发、产品测试与仿真总监

Jian Pan 目前在 Autoneum North America 公司担任声学开发、产品测试与仿真总监，负责汽车的 NVH 开发、声学材料、基准测试、DVP&R/ 物理测试、声学 / 制造仿真等工作。Jian Pan 的职业生涯始于 1990 年。当时，他在 Easi Engineering 公司担任项目工程师一职，致力于 GM EV1 等汽车的 NVH 性能和车辆及部件疲劳耐久性研究工作。随后，他又成为了福特汽车公司的研究工程师，负责 NVH 方法开发和车辆 NVH 的开发工作。他建立并验证了业内首个 1995 款福特金牛座的统计能量分析模型，且该模型适用于空气传播和结构传播道路噪声控制。由于他在这方面做出的突出贡献，他在 1996 年获得了公司的最高技术奖——亨利·福特技术奖（Henry Ford Technology Award）。1998 年，他凭借在虚拟气动 / 声学风洞的研发和部署方面做出的贡献又一次获得了亨利·福特技术奖。

多年来，他担任过许多不同的职位，并在 OEM 和一级供应商的业务流程、车辆开发、声学包装轻量化开发方面积累了丰富的经验。他发表过 30 多篇技术论文，是美国声学学会、SAE、SAE 声学材料委员会以及 SAE 噪音与振动会议组委会的成员。Jian Pan 毕业于芝加哥大学的管理人员发展项目。他拥有韦恩州立大学的 MBA 学位以及密歇根州立大学的机械工程硕士学位。他的博士论文研究方向为优化算法的收敛性和混沌行为。

Jian PAN

Director System Development, Product Testing and Simulation
Autoneum North America Inc.

Jian Pan currently works for Autoneum North America as Director of Acoustics Development, Product Testing and Simulation, responsible for vehicle NVH development, acoustic materials, benchmarking, DVP&R/Physical testing, acoustic/manufacturing simulation. He began his career with Easi Engineering in 1990 as a project engineer where he worked on NVH, durability & fatigue of vehicles and components, including GM EV1 car. Since then, he worked for Ford Motor Company as a research engineer responsible for NVH method development and vehicle NVH development. He created and validated the industry's very first Statistical Energy Analysis model of 1995 Ford Taurus, suitable for both structure-borne and airborne noise control. As a result of this work, he received the 1996 Henry Ford Technology Award (Ford's highest technical award). Jian received the second Henry Ford Technology Award in 1998 for the development and deployment of a Virtual Aerodynamic/Aeroacoustic Wind Tunnel.

He has held various management positions over the years and has broad experience in business process, vehicle development, lightweight acoustics and sound package development at OEM and tier I supplier. Jian has published over 30 technical papers. He is a member of the Acoustic Society of America, SAE, SAE Acoustic Materials Committee, and SAE Noise & Vibration Conference organizing committee. Jian is a graduate of the University of Chicago Executive Development Program. He received MBA degree from Wayne State University, and MS in Mechanical Engineering from Michigan State University. His Ph.D research was focused on convergence & chaotic behavior of optimization algorithms.

陈志东 博士

吉利汽车
NVH 及环保性能开发部 高级总工程师

陈志东博士分别在 1983 年、1993 年和 2000 年获得了南方科技大学的学士学位以及西安大略大学的硕士和博士学位。他曾在 Roush Industries, Inc. 公司和菲亚特克莱斯勒汽车公司工作。2017 年，他进入吉利汽车工作，担任高级总工程师一职。

陈博士在汽车 NVH 开发领域积累了 20 年的经验。他曾带领并参与 2006 款林肯西风、2011 款吉普大切诺基以及道奇 2010 款 RAM2500 等 10 多辆汽车的 NVH 开发工作。他是 SAE 和 ASME 的成员，也是 USCAR 车辆结构基准测试组织的创始成员。此外，他还是《国际声学与振动杂志》的审稿人和《SAE 中国汽车创新期刊》的编辑。

Dr. Gregory CHEN

Sr. Chief Engineer, NVH Development Engineering Division
Geely

Greg Chen obtained his Bachelor degree from South University of Technology in 1983, Master and Ph.D. degrees from University of Western Ontario in 1993 and 2000. He worked for Roush Industries, Inc. then for Fiat Chrysler Automobile before joining Geely Auto since 2017 as a Sr. Chief Engineer.

Greg Chen has 20 year experience in automotive NVH development. He has led/worked on the NVH development for more than ten vehicles, for instance, 2006 Lincoln Zephyr, 2011 Jeep Grand Cherokee, 2010 Dodge RAM 2500 and etc. He is a member of SAE, ASME, a founding member of the USCAR Vehicle Structure Benchmarking Group, a reviewer for International Journal of Acoustics and Vibration, an editor for SAE-China journal Automotive Innovation.

Robert Powell 博士

Simulia 软件公司
结构声学总监

Robert Powell 博士是法国达索系统旗下 Simulia 软件公司结构声学部门总监，负责车内噪音模拟软件的开发，利用计算流体力学和统计能量分析的方法模拟车内噪音。Robert 博士从 1982 年至 1995 年在波士顿 Cambridge Collaborative 公司担任科研人员，从 1995 年开始至 2008 年在福特汽车供职，并于 1999 年成为德国 Acoustic CAE 公司的高级技术专家。Robert 博士曾就读于麻省理工学院，先后获得机械工程学士、硕士、博士学位。他自 1986 年起为 SAE 会员，并于 2011-2013 年出任 SAE 噪音与振动委员会主席。

Dr. Robert Powell

Director, Structural Acoustics
Dassault Systèmes SIMULIA

Dr. Robert Powell is Director, Structural Acoustics at Simulia, a Dassault Systèmes brand, where he develops applications to simulate interior noise in vehicles using computational fluid dynamics and statistical energy analysis. From 1995-2008, Bob worked for the Ford Motor Company, becoming Senior Technical Specialist in Acoustic CAE in 1999. From 1982 to 1995, he was a Research Scientist at Cambridge Collaborative, Inc. in Boston. Bob holds S.B., S.M. and Sc.D degrees in Mechanical Engineering from the Massachusetts Institute of Technology. A member of SAE since 1986, he served as chairperson of the SAE Noise and Vibration General Committee from 2011-2013.

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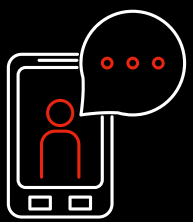

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Mark Your Calendar

Call for Papers / Presentations Deadline – Nov. 5

Expand your role within the technical community. Students and recent graduates are encouraged to submit papers, on any topic related to vehicle NVH, to be considered for the Student Paper Competition.

庞 剑 博士

长安汽车工程研究总院
副院长、总工程师

2008 年，庞剑博士开始在长安汽车全球研发中心担任副主任和首席工程师。他曾是 Stewart & Steven 石油服务有限公司的技术专家和福特汽车公司的高级工程师。

1996 年，他获得了俄克拉荷马大学的机械工程博士学位以及上海交通大学的硕士学位。

庞博士在噪声和振动控制工程，尤其是汽车工程领域拥有 30 余年的工作经验。他出版过 4 本技术书籍和 2 本文学书籍，发表过 80 多篇论文。2018 年，Wiley 出版社将出版他的新书《车身噪声与振动控制》。

他是汽车噪声振动和安全技术国家重点实验室副主任、OICA 中国噪声工作组组长以及同济大学和重庆大学的客座教授。他还曾是国际汽车工程师学会联合会（世界汽车工程师大会）噪声振动技术委员会主席。

他是中国汽车工程学会的 16 名会员之一，也是《国际汽车噪声和振动杂志》的编辑和《国际汽车设计杂志》的客座编辑。

Dr. Jian PANG

Vice President and Chief Engineer
Changan Auto Global R&D Center

Dr. Jian Pang is a vice president and chief engineer of Changan Auto Global R&D Centre since 2008. He used to be a technical specialist in Stewart & Steven Service, Inc. and a senior engineer in Ford Motor Company.

He received his Ph.D. degree in mechanical engineering from the University of Oklahoma in 1996 and MS from Shanghai Jiao Tong University.

Dr. Pang has over 30 years experience in noise and vibration control engineering, especially in vehicle engineering. He published 4 technical books, 2 literature books, and over 80 papers. The book "Vehicle Body Noise and Vibration Control" will be published by Wiley in 2018.

He serves as the vice director of China National Key Lab of Vehicle NVH and Safety, the leader of OICA China Noise Group, vice chairman of China NVH society, guest professor of Tong Ji University and Chongqing University. He used to be the chairman of NVH Technical Committee of FISITA (World Automotive Engineer Congress).

He is a fellow of Society of Automotive Engineers of China (only 16 fellows in the society). He serves as the editor of International Journal of Vehicle Noise and Vibration, and the guest editor of International Journal of Vehicle Design.

田秀杰 博士

无锡吉兴汽车声学部件科技有限公司
部门经理

田秀杰来自无锡吉兴汽车声学部件科技有限公司，公司是汽车声学包内饰供应商，主要产品是地毯、顶蓬、前围内 / 外、行李箱和发动机舱零件。

她 2012 年在中国科学技术大学取得博士学位，并有管理学学士双学位。她在吉兴的研究院工作了 6 年现在是部门主管。工作主要职责是材料研究开发、声学包相关 CAE 仿真和整车声学包开发。她成功完成多个整车声学包优化和开发项目，在此领域具有丰富经验。

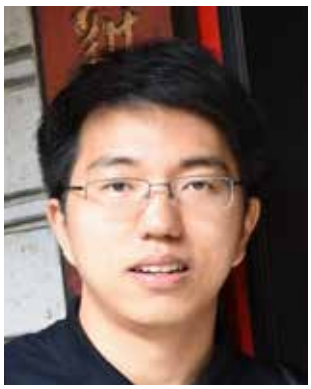
Dr. Xiujie TIAN

Department Manager
Gissing Tech

Xiujie Tian is from Gissing Tech. Co., Ltd, which is a vehicle interior supplier of sound package products. The main products are Headliner/Carpet/Dash inner/outer/Trunk trims/Engine compartment insulator.

She obtained her PhD degree from University of Science and Technology of China in 2012 and has a double degree in management. She has been working in the Gissing's R&D Institute for 6 years and now is the Department Manager. Her main responsibilities include material research and development, Sound package related CAE modeling and vehicle sound package development. And she has successfully optimizing the sound package of different vehicles and has rich experience in this field.

Wei DU



AVL STC 公司
NVH 工程师

Wei Du 目前是 AVL STC 公司的 NVH 工程师，负责公司的中国 AVL NVH 项目的售前和实施支持。2011 年，他毕业于重庆大学，获得了该大学的机电一体化硕士学位。毕业后，他进入长安福特汽车公司工作，担任 NVH 工程师一职。在此后近五年的时间里，他在 PT NVH 故障排除和车辆 NVH 集成开发方面积累了丰富的经验。之后，他在西门子工业软件公司担任了两天的 LMS 测试支持工程师。他的专业领域是 PT NVH 测试、相关的 NVH 开发和故障排除。

Wei DU

NVH Engineer
AVL List Technical Center Shanghai Co., Ltd.

Wei Du, is currently the NVH engineer in AVL STC, responsible for pre-sales and implementation support for AVL NVH programs in China. He graduated from Chongqing University and got master degree of mechatronics in 2011, then worked as NVH engineer in Changan Ford company for nearly five years, and accumulated rich experience in PT NVH trouble shooting and vehicle NVH integration development. Afterwards, he worked as LMS test support engineer in Siemens Industry Software Company for two years. His strength lies in PT NVH testing, related NVH development and trouble shooting.

高海涛

采埃孚
NVH 工程师

2011 – 2013	担任昆山玛吉斯轮胎 NVH 工程师 @ 室外测试评估部 乘坐体验以及乘用车轮胎的舒适性 ISO 362 & ECE R117 车外噪声
2014 – 2016	担任博泽中国的 NVH 工程师 @ 开发部门 乘用车附件 NVH（车门、尾门和座椅系统）
2017 – 至今	现担任采埃孚中国的 NVH 工程师 @ 基础开发部门 乘用车动力传动系统（变速箱、底盘、e-Drive 电动轴 /e-Axle 电力驱动）

Haitao GAO

NVH Engineer
ZF Friedrichshafen AG

2011 – 2013	Worked as a NVH engineer in MAXXIS tire KUNSHAN @ outdoor testing & evaluating dept. Ride and comfort for passenger car tires. ISO 362 & ECE R117 exterior noise.
2014 – 2016	Worked as a NVH engineer in Brose China @ development dept. Passenger car accessory parts NVH. (Door, tailgate, seat system)
2017 – Now	Work as a NVH engineer in ZF China @ fundamental development dept. Passenger car driveline NVH.(Transmission, chassis, e-Drive / e-Axle)

Kiran Govindswamy 博士

FEV 北美
动力总成、车辆工程与 NVH 副总裁

Kiran Govindswamy 博士目前是位于密歇根州奥本山的 FEV 公司北美技术中心的副总裁，主要负责变速箱开发、车辆工程和 NVH 方面的工作。在 FEV 公司任职的 18 年间，他曾担任过工程、管理方面的职务以及车辆 NVH、动力总成 NVH、CAE、变速箱开发和动力总成系统集成领域的领导工作。

他拥有印度浦那工程学院的机械工程学士学位以及宾夕法尼亚州立大学的硕士和博士学位。Kiran 是 SAE NVH 会议委员会的成员，也是 CTI- 美国变速箱研讨会咨询委员会的成员。

Dr. Kiran Govindswamy

Vice President, Powertrain, Vehicle Engineering & NVH
FEV North America Inc.

Kiran Govindswamy currently holds the position of Vice President at FEV's North American Technical Center (Auburn Hills, Michigan) with responsibilities for Transmission Development, Vehicle Engineering, and NVH. Kiran's 18-year tenure at FEV has included engineering, management, and leadership positions in the areas of vehicle NVH, powertrain NVH, CAE, transmission development, and powertrain integration.

Kiran's academic background includes a Bachelor's Degree in Mechanical Engineering from the College of Engineering, Pune, India and Master's and Doctoral Degrees from the Pennsylvania State University. Kiran serves as a member of the SAE NVH Conference Committee. He is also a member of the advisory board for CTI - USA Transmission Symposium.

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Dassault Systèmes successfully completed the acquisition of Exa Corporation on November 17, 2017. The Exa products will be part of the growing multiphysics simulation portfolio of SIMULIA, a Dassault Systèmes brand.

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ANSYS OPTIS公司是全球领先的光学物理仿真软件和人眼视觉仿真及虚拟现实系统开发商。

ANSYS GENESIS是ANSYS OPTIS的子公司，同时是全球声音设计和声学模拟器领域的领导者。我们专注于心理声学、声学信号处理、声音设计和音景模拟的咨询和软件产品。作为感知分析，3D回放和模拟的先驱，ANSYS GENESIS参与了许多与国际大型公司和世界级研究机构的研究项目。

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ANSYS OPTIS is the world leading software editor for the scientific simulation of light and human vision within a Virtual Reality Environment. ANSYS GENESIS is an affiliate of ANSYS OPTIS and is a world leader in the field of Sound Design and Acoustic Simulators. We specialize in consulting and software products in psychoacoustics, acoustic signal processing, sound design and soundscape simulation. As a pioneer in perception analysis, 3D playback and simulation, ANSYS GENESIS is involved in many research projects with major companies and world-class research institutes.

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At ANSYS GENESIS, we provide tools and techniques to make the sounds in our environment better, more comfortable and more significant. We offer our competencies in the form of products, consulting and research works.

S

拾音汽车科技（上海）有限公司

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拾音科技是国内最专业的第三方NVH工程服务商，联合了德国工程分析和美国设备设施团队，旨在为国内车企提供性能量化设计及分解验证服务和产品，包括：NVH &CAE开发服务、测试工具、及零件产品预研等，不断致力于NVH开发重心不断前移。

拾音专研于独特的NVH子系统测试解决方案，并联合战略合作伙伴ECKEL打造全球最顶尖的消声室。未来，拾音引领着主动噪声管理（ASM，含主动降噪ANC、主动生效ASD）零件产品的研发落地。

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SineTac provide unique subsystem test bench to customer, meanwhile, with our strategic partner ECKEL, SineTac also provide the best acoustic testing solutions, redefine the anechoic chamber in China. For production, SineTac is now leading research of ASM(include ANC and ASD) for the further industrialization.

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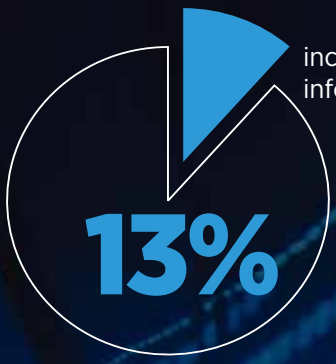

increase in engineer's time spent searching for information in 2013 than in 2002[1]

15 HOURS a week spent by the average engineer searching for information online[2]

13 unique data sources are used to address each engineering challenge[3]

? How do you stop searching for new information and start contributing to a constantly evolving industry?

1,408 standards added each year

1,829 technical papers added each year

226,000+ authoritative resources created by and for automotive and aerospace engineers

143,000+ technical papers

42,000+ standards

6,700+ journal articles

1 click

DRIVE THE INDUSTRY in new directions. Your innovations + SAE MOBILUS platform = continuous education

Contact Your Administrator to Get Your Login Info:

Shitong XING
Sales Account Manager - APAC
o +86-21-6140-8916
e Shitong.Xing@sae.org

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FORTY-THOUSAND

users depend on SAE MOBILUS technical resource platform to power daily decisions.

1 Jones, Jeanette. "Various Survey Statistics: Workers Spend Too Much Time Searching for Information." Cottrill Research RSS 092. 8 Nov. 2013. Web. 10 Mar. 2016.
2. An empirical analysis of engineers' information behaviors, Mark A. Robinson, Journal of the American Society for Information Science and Technology Volume 61, Issue 4, pages 640–658, April 2010
3. Aberdeen: www.sla.org/guest-post-13-really-scary-number-youre-knowledge-worker/