

# KISTLER

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## Shaping the sound of future mobility

Kistler supports CAERI with measurement solutions for Noise,  
Vibration and Harshness testing



In CAERI's electric powertrain laboratory, Kistler measurement technology plays a key part in advanced NVH testing for new energy powertrains.

**At the China Automotive Engineering Research Institute (CAERI), NVH testing now plays a major role in fostering the evolution of cars throughout China and beyond. CAERI operates various advanced facilities where its engineers use measurement technologies from Kistler for NVH tests on vehicles and their components.**

Surveys of the growing Chinese automobile market show that both consumers and manufacturers are demanding quieter and more comfortable vehicles, a trend that is gaining more momentum now that electric and hybrid vehicle sales achieve breakthrough growth. By eliminating the noise from combustion engines, electric vehicles create a much quieter environment, however, this also makes noise and vibration from other sources more noticeable, even to the point of causing annoyance. China has made impressive progress with NVH (Noise, Vibration and Harshness) testing in recent years, and CAERI is one of the key drivers of this successful development.

Headquartered in Chongqing, the China Automotive Engineering Research Institute (CAERI) is a publicly listed R&D center that numbers among the technology leaders of China's automotive



The China Automotive Engineering Research Institute (CAERI), a leading R&D institute for NVH testing, is driving China's automotive technology ahead with the help of sensors, data acquisition and software from Kistler.

industry. Ever since it was founded in the 1960s, CAERI has focused on vehicle R&D, testing, and quality inspection: to date, the institute has developed more than 300 vehicle models, 30 engine types and 80 new materials or processes, as well as drafting over 300 national industry standards. CAERI's State Key Laboratory of Vehicle NVH and Safety Center, established in 2010, is China's highest-level NVH research facility: activities here include testing, verification and development of solutions for vehicles, systems and components covering both software and hardware.

#### **Cutting-edge measurement technology drives advanced NVH testing**

"With the support of our State Key Laboratory and the Chongqing Research Center of Vehicle NVH Engineering and Technology, we've developed new technologies for NVH, fatigue and durability testing in China," says Dr. Li Peiran, Deputy Director of the CAERI Automotive Engineering Technology Center and Director of the CAERI NVH Technology Center. Dr. Li has led CAERI's NVH research for over 10 years: this senior engineer and his team rely on dynamic measurement technology from Kistler. "We collaborate closely with Kistler to help our customers identify and address technical problems, enabling them to optimize their products."

What makes NVH engineering so special? And what resources are necessary for success in this field? Among the key factors here are the new scenarios created by electric and hybrid vehicles, such as changes in design logic or the use of two different powertrain systems: these have presented NVH test engineers with some major challenges. Wu Yong, an NVH engineer at CAERI who specializes in performance optimization and noise cancelling, explains: "Vehicle NVH testing is much more complicated than most other processes. First: the constantly changing state of a vehicle during starting, driving and braking makes it an unstable and complex system. That's why huge amounts of data are required to identify the sources and triggers of certain symptoms. And second: source



An 8763B accelerometer from Kistler is mounted on a steering wheel for NVH testing at the China Automotive Engineering Research Institute (CAERI) in Chongqing.



For NVH analyses of powertrains, components and auxiliary systems, the engineers at CAERI rely on force and vibration sensors from Kistler – such as this 8763B ceramic shear miniature IEPE accelerometer.

identification is not the end of the process. To determine the transmission medium or receiving ends, we have to understand the vehicle's inner working mechanism – and that calls for a great deal of testing, as well as multi-factor analyses."

#### Accurately measuring vehicle and powertrain NVH

With the help of accelerometers from Kistler, the NVH engineers at CAERI are able to attain a new level of NVH optimization. Typical scenarios include steering vibration testing, thermal management system vibration testing, and further analyses at vehicle and component levels. One of the principal products used for NVH testing at CAERI is the 8763B triaxial IEPE accelerometer from Kistler. This ultra-compact, lightweight and robust cube accelerometer with an edge length of only 10.9 mm (0.43 in) includes three threaded holes for enhanced efficiency and flexibility during the mounting phase and when selecting the orientation.

**"Over the years, we have contributed several cutting-edge NVH technologies to the industry, and we've helped various automakers to develop high-quality vehicles."**

*Dr. Li Peiran, Deputy Director of the CAERI Automotive Engineering Technology Center and Director of the CAERI NVH Technology Center*

For electric powertrain testing, the 8763B is available with multiple measuring ranges (from 50 g to 2,000 g); it features a wide usable frequency response (up to 15 kHz±10%) combined with high immunity to electromagnetic fields. Last but not least: small vibrations that are typical of electric motors can now be captured even more accurately, because further product refinements have been introduced to significantly reduce the noise threshold compared to the previous version of the product. As an added benefit for CAERI's NVH engineers, all Kistler sensors can be easily operated with different kinds of data acquisition software, with almost no extra time needed to spend for preparation.

#### Reliable development partnership fosters innovation

CAERI's advanced NVH testing facilities – equipped with state-of-the-art measurement technology from Kistler – enable numerous customers to develop and improve their vehicles:

examples include ChangAn Auto, BAIC Motor, Dongfeng Motor and BYD. The final words from Dr. Li: "Over the years, we have contributed several cutting-edge NVH technologies to the industry, and we've helped various automakers to develop high-quality vehicles." Many of the best-selling models in the Chinese market and beyond would have been impossible without CAERI's R&D work, and the Institute is sure to continue placing its trust in Kistler technology going forward.



Advanced accelerometers and DAQ systems from Kistler help CAERI perform holistic NVH tests, optimize vehicles and define new industry standards in China.

#### At the forefront of NVH research and development in China

CAERI's NVH testing facilities support diverse test scenarios with precisely defined operating conditions:

- A semi-anechoic chamber with low-noise four-wheel drive drums suitable for vehicle NVH testing and simulation
- A fully anechoic chamber (sound absorption: >0.99, background noise: 13 dBA) for sound pressure and sound power testing of components, and calibration of acoustic materials and instruments
- A reverberation chamber with a long reverberation time for sound fields from 1,500 to 4,000 Hz – used to test vehicle sound deadening, and for noise testing and absorption coefficient testing of interior materials
- A five-shaft electric powertrain laboratory for new energy powertrains (such as motors, electric drive assemblies, transmissions, and electric drive axles)
- An electromagnetic road testing laboratory that simulates road temperature, illumination, humidity and durability scenarios

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cavity  
base

NVH testing –  
from sensor to  
answer

NVH testing:  
data acquisition  
and analysis

Comprehensive  
powertrain diagnostics

Visual data:  
the basis for engine  
development

Optical combustion  
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