Pressure points

automotive testing expo 2018 ★ NOVI ★ ★ MICHIGAN ★ EXHIBITOR

The challenges of acquiring pressure distribution data during safety tests can be overcome by utilizing fast and responsive imaging sensors and electronics

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The capacitive design of the sensors ensures that they maintain their calibration throughout their lifetime

With customers in more than 50 countries and a network of distribution partners in Europe, Asia-Pacific and South America, XSENSOR Technology has more than 20 years' experience in pressure imaging. The company, which is exhibiting at Automotive Testing Expo 2018 in Novi, Michigan, started out in the medical industry, working in pressure ulcer prevention, and has since grown into a world leader in pressure imaging technology, spanning multiple disciplines.

Headquartered in Calgary, Canada, the company offers flexible and conforming sensors that can be bent or contoured while maintaining accuracy and repeatability. Bruce Malkinson, COO, explains that in the engineering and design community, test applications range from tire tread analysis, door seal consistency, wiper blade profiling, automotive comfort, and production quality assurance to tactile pressures for hands and feet. "All of our sensors, electronics, and software are designed and manufactured in-house, providing complete system solutions," he says.

For the past three years, XSENSOR has been developing high-speed sensors, dataloggers, and software designed to perform, record and post-process impact events at up to 7,750fps. Malkinson says, "Due to industry demand for high-speed data acquisition, with sensors providing fast response rates as well as the ability to illustrate impact tests, we have developed a tool to visualize pressures in a variety of safety test scenarios."

Indeed, the company's new product offering provides an impact sensor with the ability to record at up to 7,750fps and datalogger scanning at up to 8,000,000 sensels/second with 16bit resolution. The new software, Malkinson explains, is able to download the recorded data and apply calibration files to it, all of which is subsequently visualized in a new software format.

The capacitive sensor has a patented dielectric that has been designed with an extremely fast response rate, with a 3dB point of over 150Hz to capture impact events. "The sensor is then calibrated with a procedure that mimics the testing speeds," explains Malkinson. "We've had to design a unique datalogger with a speed of more than 1,000Hz in order to process all the sensing points – more than 2,000 – in the array."

This DAQ can be attached to a crash sled for a variety of impact scenarios. An external trigger can initiate the recording on the datalogger. Options are available within the software to enable a variety of recording options, such as setting pre-triggers, engaging recording based on thresholds of pressure or contact area, adjusting recording speeds to match with other recording devices, and programming multiple sensor thresholds and triggers for one impact.

BODY CONTACT

The new platform of high-speed pressure imaging can be used in automotive impact testing for seats, airbags, seatbelts, child seats, protective equipment evaluation for helmets, and other sport and military equipment, and dynamic tire testing for speeds in excess of 120km/h (75mph).

Malkinson discusses the advantages of using the XSENSOR impact system for seating: "It enables the

designer and safety evaluators to understand where the body makes contact with the seat, and how the pressures applied impact the person and affect the seat design." He reveals that previously engineers had to rely on dummy sensors and data from high-speed cameras, whereas now they can visualize what is happening to the subject on the seat surface. "For the first time, data shows how the subject compresses onto the surface and how the safety designs in the seat respond to the impact."

Creating such a system initially meant developing a new sensor that was able to respond quickly enough in impact scenarios while still maintaining a very thin and conforming sensor design that doesn't affect the seat or testing procedures. Says Malkinson, "The sensor had to react fast enough to record the impact and respond quickly enough for any additional movements or changes throughout and after impact. This involved designing new dielectrics that could meet these test scenarios."

BESPOKE SOLUTION

The next step involved designing and manufacturing a unique datalogger to handle between 1,000 and 65,000 sensing points. On the challenges of this, Malkinson says the DAQ had to gather all sensing points and record in a way that enabled the software to manage the recorded data, decompress the information, and open data in calibrated units.

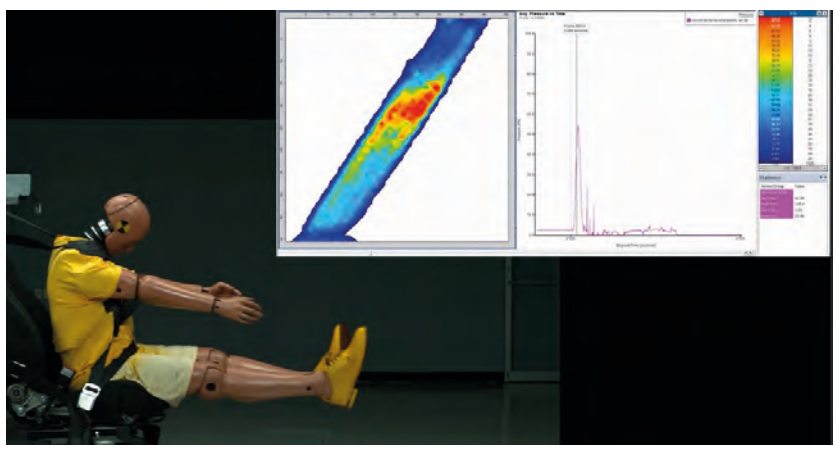
"The combination of the sensor properties, the data transmission rates, and the software functionality means that safety engineers can now see pressure images from the entire impact scenario at speeds that are similar to other measurement tools. For the first time, pressure imaging can provide pressure data that's fast enough to visualize the impact of car seats, airbags and seatbelts."

XSENSOR offers a new approach to understanding impact testing, by providing a detailed map of the pressure impact on a surface – for instance, a whiplash test using a dummy can now show more than 3,000 sensing points on the surface of the back of a car seat to evaluate what parts of the dummy make contact with the seat and at precisely which moment of impact. "This provides new insights into safety design," says Malkinson, "and it can assist with all the other tools available to make a person safer in a vehicle."

According to Malkinson, although pressure imaging is a niche area of expertise, there is an increasing need for OEMs and product designers to understand human interface pressures so that products can be better designed. "Moving forward, there will be more opportunities to integrate pressure imaging into more test scenarios and production controls. From effectively producing touchscreen devices, to understanding human interface pressures at impact in extended-use scenarios, the requirement to understand contact pressures, and eventually react and respond to needs, will continue to grow." ❮

ABOVE: The data logger can be attached to crash sleds and triggered remotely for repeated test procedures

BELOW: XSENSOR's HS Pro V8 software allows users to view live or post-process, and then analyze the data



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Bruce Malkinson, chief operating officer, XSENSOR Technology