Testing of hybrid and electric vehicle systems

In recent years, hybrid and electric technologies have been developing rapidly and TRW Conekt has advanced its testing capabilities to meet changing industry demands. Conventional environmental testing plays its part in helping to develop robust designs, however, product robustness and reliability for new technologies requires more than the implementation of current practices. Conekt prides itself on pro-actively developing and leading new testing protocols to support technology introduction and it has already enabled a number of technology-leaders in hybrid and electric vehicles to successfully introduce new products.

Conekt hybrid technology support projects include:

- EMC testing of starter- alternator
- Adapting 12V automotive electronics for high-voltage electric vehicle applications, such as an Electro-hydraulic steering and an anti-lock braking systems
- 75kW integrated drive-train package environmental and EMC testing
- Technology Strategy Board projects
  - -Enhanced Fuel Cell System
  - -YAMOG Axial Flux Motor
- Enviromental testing of 55kW integrated drive-train
- Driverless Taxi steering system
- Enviromental testing of Lithium-Ion EV battery packaging
- Zero emissions fuel cell hybrid taxi

Underpinned by competencies in:

- Environmental and EMC testing (UKAS testing laboratory No. 0332)
- 50 years of experience in new technology introduction
- Formal approaches to operating, risk and hazard analyses
- Mechanical and electronic design for test rigs and fixtures
- Reliability Analysis
- Materials and Failure Analysis, with extensive capabilities including real-time X-ray and Scanning Electron Microscope Energy Dispersive X-ray Spectrometry (SEM EDS) analyses

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Developing Advanced Testing Protocols

New testing protocols are generally required for new technology introduction. Relying on existing testing approaches used for older technologies can leave deficiencies in the test coverage. Such examples in hybrid vehicles may be poor analysis of the operating regime (more stop-start activity) or determining the worst-case EMC operating mode amongst a drive system's many functional states.

Deficiencies in the test coverage may go unnoticed to vehicle developers and integrators until the vehicles are in the hands of the users, and even then such omissions in the test coverage may only be seen by a few users. However, if the outcome is an anomaly in a critical function, for example during electrical retardation and brake blending, then it may become more that just a minor user complaint.

Bringing new technology into the mass-market carries with it a responsibility to anticipate and to act to mitigate risks that may never have existed with similar, conventional technologies and therefore existing testing protocols may be insufficient.

The Conekt Approach

As an engineering consultancy and test service organisation, Conekt has a wide breadth of expertise in developing prototype systems and of manufacture for niche applications. Conekt is therefore able to offer comprehensive support to its customers testing needs by looking deeply into the product application and the technologies it uses to ensure testing protocols are tailored to address the needs of new applications.

Benefits

Testing and reliability activities are often subject to financial limitations as activities are undertaken at the end of a programme. Conekt can support the development of testing protocols earlier in the design process that aids development and reduces final costs.

Identifying seemingly small changes during the design cycle reduces potential complications before production, minimising the probability of product recalls. For example, a mechatronic system had undergone nine months of conventional testing with one observed unexpected failure mode, which was then remedied. Conekt was invited to review the results before production jigging was ordered.

A stepped-stress protocol was developed and proposed that targeted some features that were considered risk areas for the new technology introduction. After only two weeks of the custom-designed stepped-stress testing, ten further failure modes that had been missed by conventional testing were identified. The customer enjoyed a 'clean' and on-time launch of the product. New tests were then introduced into the customer's test schedule for the next product iteration, locking in that new understanding.

Technology-led development testing aims to bring the benefits of:

- Design-cycle relevant testing, capable of usefully feeding into an emerging design
- Aid reliability growth
- More cost-effective testing with quicker turn-around of results
- Establishing testing criteria for future variants
- Cleaner Product Launch with less post-launch fire-fighting
- Higher end-user satisfaction
- Lower warranty costs
- Lasting reputation for quality

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