

Proceedings for Panel: *The Electrifying Pace of Automotive PHM*

Aim: To summarize for the wider community the issues identified by the panelists and the audience and identify collective priorities and recommendations for way(s) forward in a concise format for the panel chair to complete and submit

Panel Summary *Increasing electric and electronic content in modern day vehicles is bringing value to the customers but also adding to vehicle complexity. US-based OEMs and suppliers collectively paid about 7.4 billion USD in 2016 for warranty claims – with 50% or more related to electric or electronic components. With increasingly tight emission requirements and growing societal pressures, the auto industry is turning toward electric vehicles. More component sensing is possible than ever before, and more vehicles are boasting 4G connectivity that is essential to off-load data for cloud-based analytics. PHM demands a strategic approach aligned not only with company goals and product requirements but also linked into its field service support. This panel will explore the challenges and opportunities posed by the increasingly electrified automotive market and how PHM technologies can help mitigate warranty costs.*

Speakers/Presentations with links

1. Riegel Daniel: Bosch, Germany
2. Dr. Ravi Patankar: KPIT, USA
3. Regan Dixon: General Motors, Canada
4. Prof. Michael Pecht: University of Maryland, USA
5. Steve Holland: Principal Consultant, VHM Innovations LLC, USA

Summary of Key Issues from 20-30 minute open discussion

Speakers (from their talks):

1. Looked at ECU failures and how failures can be predicted by stress monitoring.
2. Talked about how system variability possess a challenge in successfully deploying PHM across fleet based on physics of failure models
3. Highlighted how information overloading of technician is going to impact future trouble shooting as more and more components, and systems will be added
4. Identified a gap between monitors we have and the root cause analysis
5. Talked about use cases and business cases of future automotive applications – how earlier prediction can help reduce crashes and congestion.
6. Looked at the PHM from a reliability perspective. Talked about how to build qualitative tests and how testing to failure may not be necessary – only testing until anomalous behavior may suffice.

7. Talked about large sums of money is wasted on no trouble found cases, and no fault found cases.
8. How perceived perception of quality can improve by turning an emergency repair into planned maintenance.
9. Talked about how organizational barriers, and communication issues remain a major problem

Audience:

1. How fleet management can be carried out for EVs – the cost for leasing EVs is equivalent to the degradation in battery health for the term of lease in Chile. How prognostics can be created to educate the user for minimal battery degradation.
 - a. Customers demand will eventually drive creation of these kind of prescriptive prognostics
 - b. Fleet management for automotive should really be similar to fleet management of every other fleet – regardless of the nature of the fleet
2. What is better – data driven models or physics based models
 - a. Depends on the application at hand. If you know your product, you are better off with physics based models. If the product is from a supplier, and is a black box for you, then perhaps data driven model is your best bet.
3. When can you add sensors specifically for prognostics application – when is it justified
 - a. Depends on the business case and the value it bring – generally the financial team does a pretty good job in ascertaining it.
 - b. Generally in our experience, the information that is available from the existing sensors and controls suffices to monitor health of concerning systems
 - c. Can also depend on the criticality of the system and the consequences of not doing a good job in monitoring the health
4. How much data is generally necessary to validate an algorithm to make it production worthy
 - a. Very subjective – depends on the requirements, and the impacts of false positives and negatives
5. Who should own the data?
 - a. [Opinion based answer] the one who owns or uses the product

- b. Can have agreements in place, and make data less concerning by avoiding to collect personal information e.g. how fast the user is going, the gps coordinates of the user, etc
- c. Another relevant question is – who should be allowed to use the data. In the case of tier 1 or tier two suppliers, the data seldom makes it to the end customer.

Prioritization of Issues Following open discussion and ranking

None

Recommendations for Way Forward

None

More time should be set aside for Q&A

Number of Attendees: 48