



Prognostics and Health Management Society Conference 2016 -
Smart Manufacturing PHM Panel

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SMART MANUFACTURING – INDUSTRY NEWS AND INTEREST LEVEL

Original Equipment Manufacturers (OEMs)

1. Cosen – Smart Saw¹

- Cloud based system.
- Monitors the performance of a blade.
- Accurately forecast the number of remaining cutting hours left before a saw blade dulls and is no longer cutting with precision or a complete breakage.

2. Fanuc - Zero Down Time²

- Robot health monitoring solution by FANUC is already deployed at several General Motors automotive factories.

COMMENT: **It appears some OEM's already have commercial solutions, while many others are working towards predictive monitoring technology for their machines (machine tools, industrial robots, etc.).**

End Users / Overall Industry Direction

1. Industry 4.0 / Smart Factory

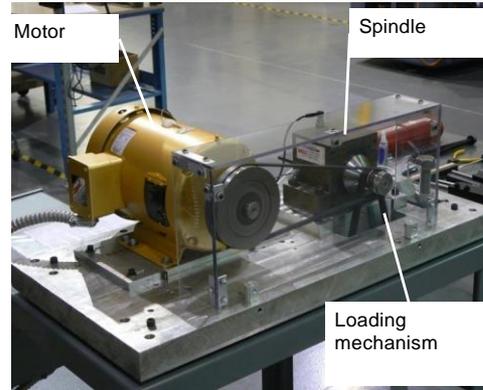
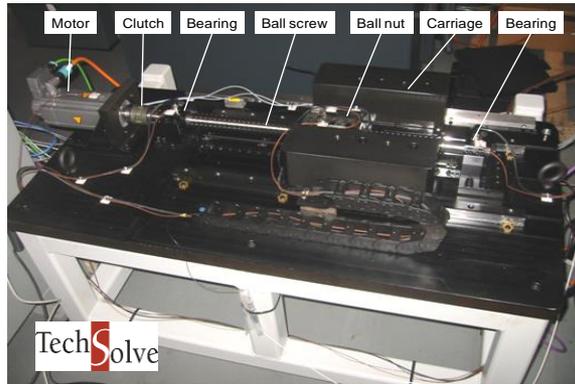
COMMENT: **Although industry 4.0 and smart factory are popular topics, for end-users/manufacturers, it seems that some organizational and culture shifts are still underway and this transformation will take time.**

¹<http://www.cosen.com/news/news/cosen-introduces-technology-that-will-revolutionize-the-metalworking--amp--fabrication-industry>

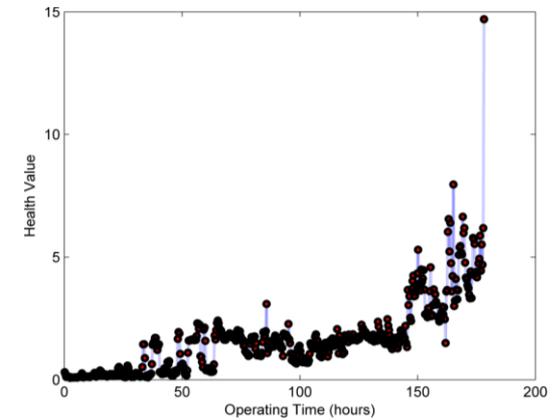
²<http://www.fanucamerica.com/FanucAmerica-news/Press-releases/PressReleaseDetails.aspx?id=80>

PAST WORK ON MANUFACTURING PHM

Feed-Axis and Spindle Bearing Test-beds

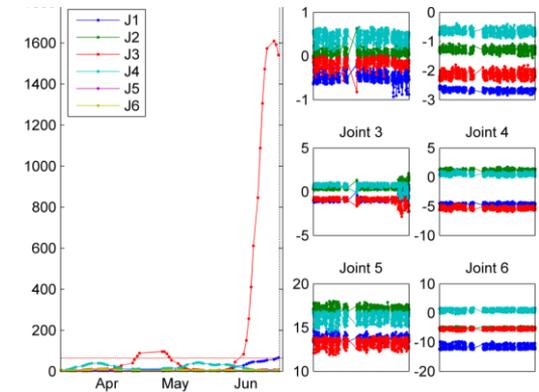
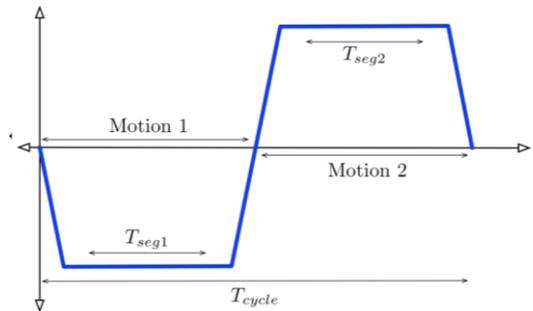


Spindle Bearing Health Results

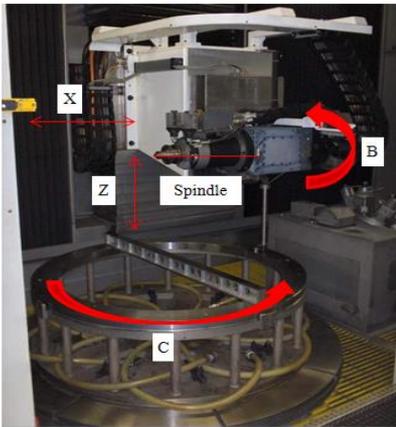


- Test-beds and a Milltronics machine tool (in collaboration with TechSolve) were used for demonstration health monitoring technology for spindle bearing, feed axis, and tool-holder unbalance.

- This was an initial project on monitoring the health condition of industrial robots for an automotive manufacturer.
- This research was further commercialized.

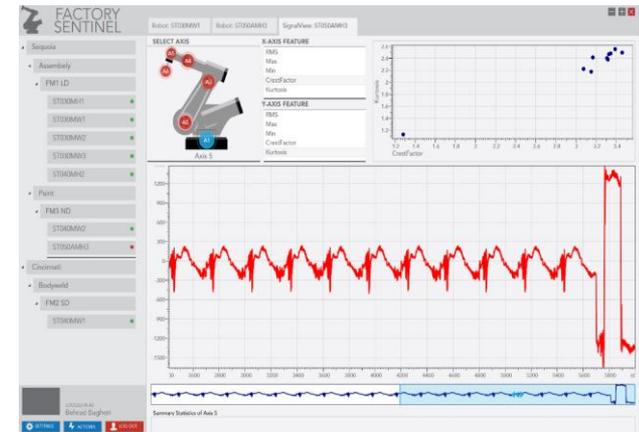
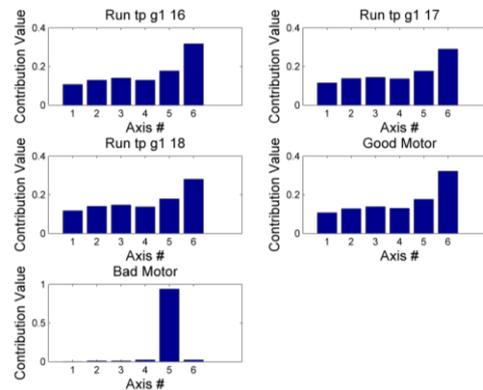
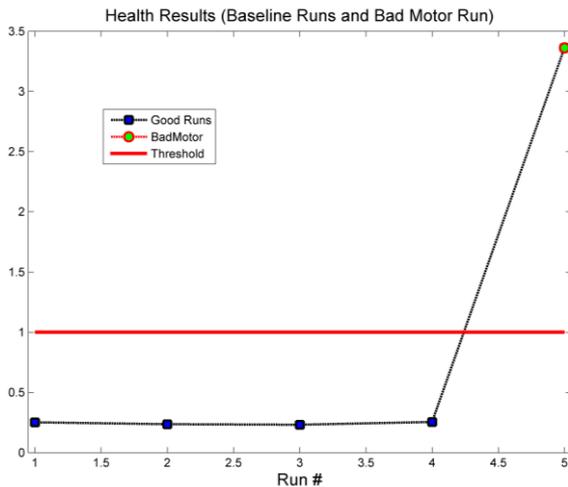
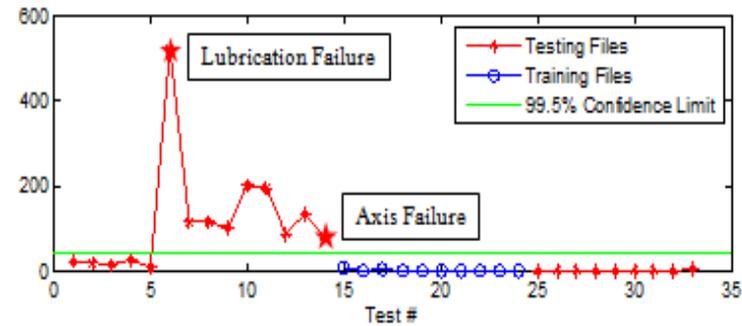


PAST WORK ON MANUFACTURING PHM



- Initial study was with four industrial CNC grinding machines.
- Five axes per machine.
 - Two translational.
 - Two rotational.
 - One spindle (cutting axis).

Health Monitoring Results



- Factory Sentinel is our robot health monitoring software

THE NEED FOR STANDARDS, GUIDELINES, REFERENCE METHODS, AND REFERENCE DATA SETS

1. Getting the right data is half the challenge; standards could help in this area.
2. No well accepted way for aggregating these various data sources – manufacturing data can be large already, but will only get bigger.
3. Development of a machine-based PHM system normally follows a typical procedure but there is no set documents or guidelines for manufacturing (for system level PHM, it is even less defined).
4. Reference material on common failure modes and past use cases would also aid the industry.
5. Reference data sets are lacking and failure events are rare, thus validation is quite difficult and this limits its widespread adoption.

Thank you for your attention...

If you have questions, we can be reached at:

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