First steps towards the development of a digital twin.



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Content





Introduction & Definition

" Its a virtual representation employed to understand and foretell the behavior of its physical equivalent"





DT at health

DT modelling for vaccine manufacturing[1] Digital Twin strategy in the pharmaceutical industry- https://www.infosys.com/insights/iot/documents/building-digital-twin.pdf



DT Strategy to Stabilize Ventilator Demand Amidst Pandemic

Image Lungs and créate 3D model

₩

Run Sims of blood And Oxygen Flow Train AI with Simulation Data Predict Ventilation Requiriments



BreathEasy project- https://www.enterpriseai.news/2020/04/15/onscale-launches-project-breatheasy/

Update Digital Twin



Potential of the DT





3D Representation



Visualization



Data Model



Model Syncrhronization



Simulation



Document Manager



Model



Connected analytics







METHODOLOGY : Vibration analysis system for farm tractor differential

Metrological projects are focused in the develop of systems that adapts to the costumer needs, in this case a vibration analysis system test cell was developed to measure the "health" of the mechanism inside of a tractor differential in a production line





Important aspects of the proyect:

Vibration analysis system for farm tractor differential

Creation of a Line for Design and Manufacture of Equipment for Functional Testing of Automotive Transmissions.

- One of the most fruitful avenues for innovation in metrology is when integrating measurement technology into direct industrial application equipment.
- Online functional and dynamic measurement is fundamental to smart manufacturing systems (Industry 4.0 & Digital Twins).
- The measurement of functional parameters of manufactured systems poses complex challenges due to the combination of variables involved.
- This article shows a successful example of systems integration for measurement of this type, achieved by the institutional collaboration with stakeholders.
- It is hoped that examples such as this one will open the way for the development of an integration and instrumentation industry at SIM.





Echeverria – Villagomez, J.S, Zambrano, L, etal. Metrology Investment Porjectsfor process effectiveness. NCSL, Tx, USA 2015

Know and then undestand the needs:

Vibration analysis system for farm tractor differential

The client

- Manufactures and assembles powertrain differential mechanisms for tractors.
- All powertrain components combine material (strength, hardness, weight...), dimensional (length, diameters, complex shapes...) and functional requirements.
- Among the functional requirements of a differential gearbox are:
 - Pinion and Gear interaction.
 - Misalignment
 - Bearings.
 - Backlash.
 - Torque or residual friction torque.
- The Customer requires, at the end of its assembly line, a work station that allows to measure the previous parameters and others coming from vibrations inside the mechanism, at 100% of its production, in a dynamic way, and to determine if the differential passes or does not pass according to a study made to the different models.
- M2M communication







https://www.grainews.ca/machinery-shop/how-it-works-the-differential/

Create a model: Vibration analysis system for farm tractor differential







Calvek-Design/CENAM collaboration-MJD Differential Elements

Test & Evaluation: Vibration analysis system for farm tractor differential





Calvek/CENAM collaboration-MJD Differential Elements

Transfer Metrology Know how: Vibration analysis system for farm tractor differential





Calvek-Design/CENAM collaboration-MJD Differential Elements

M2M Communication:

Vibration analysis system for farm tractor differential

CENTRO NACIONAL DE METRO

Developed Software in LabVIEW+ XML

communication stage







Calvek/CENAM collaboration-MJD Differential Elements

M2M Communication: Vibration analysis system for farm tractor differential



• The system works as follow:





M2M Metrology Parameters: Vibration analysis system for farm tractor differential

• The system works as follow:

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71944	0.45534	19.7470	0.89671	16.00811	0.39172	0	0	97064	0.24574	6.39513	0.54517	12.88077	0.19743	0	0
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2610	0.45835	18.30544	0.95234	15.00917	0.39108			8.51652	0.24907	6.26527	0.53883	12.93902	0.19685		
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Collected data obtained of the test of the differentials to stablish new limits





Data Base input : Vibration analysis system for farm tractor differential

• The system works as follow:

Developed algorithm to send the results in XML and then to the data cloud





Real **CENAVECALVER** CENAM-CALVEK-MJD ENAM-CALVEK-MJD AM-CALVEK-MJD

Data Raw DATA XML Data CC Accelerometer CC DAQ

Info-Calculed New Trends

Process/Adjustment





Virtual / Client Software

Digital Component Twinning: Vibration analysis system for farm tractor differential



Work in progress: Digital Twin Implementations

Add Agile Model to develop Projects (MESURA+AGILE) Include DCC to digital traceability and DT actualization. Implement our own AI algorithms for focusing on metrology. Implement DPS for Real Time process improvement Develop better toolkits of XML Metadata Remote Verification for accelerometers





Digital Twins

宋学官,来孝楠,郭正刚,邱一鸣,孙伟



Metrology for Digital Transformation SIM Conference 2021 September 1st and 2nd organized by SIM-MWG-14



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