



The 17th ANSHM Workshop (2025 NEWCASTLE)

Ansys Digital Twin

Rhys Young

November 20, 2025

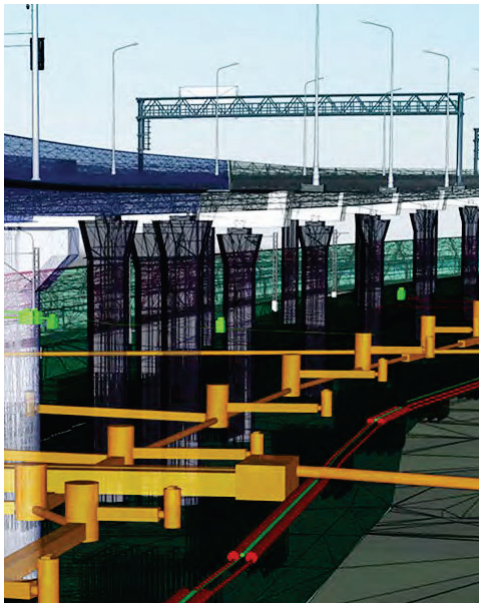
©2025. Proprietary. Do Not Share.

Digital Twin – Just a buzz word?



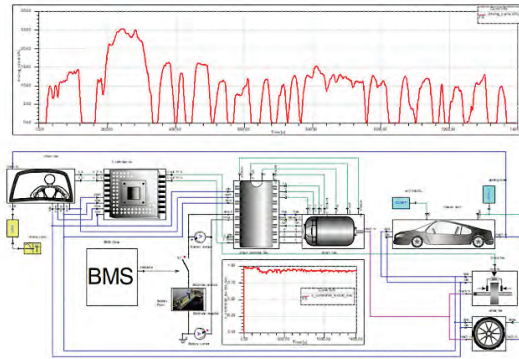
A *Virtual* Twin

to map the digital geography of the entire plant — the spatial model.



A *Process* Twin

to capture the dynamic model of process behavior— from heat transfer and pressure fluctuations to reactions and heat exchange.



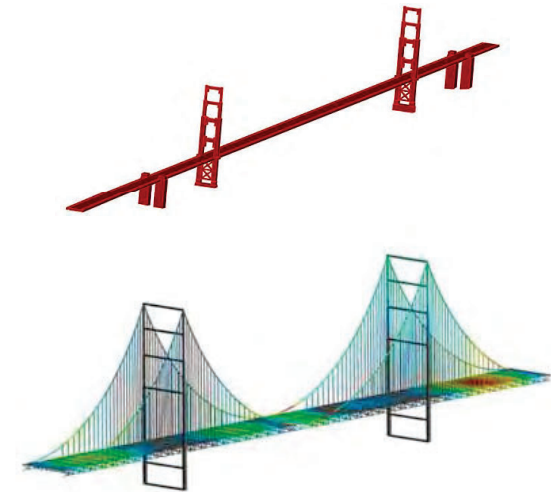
A *Control* Twin

to capture how control systems and process dynamics interact under changing conditions.

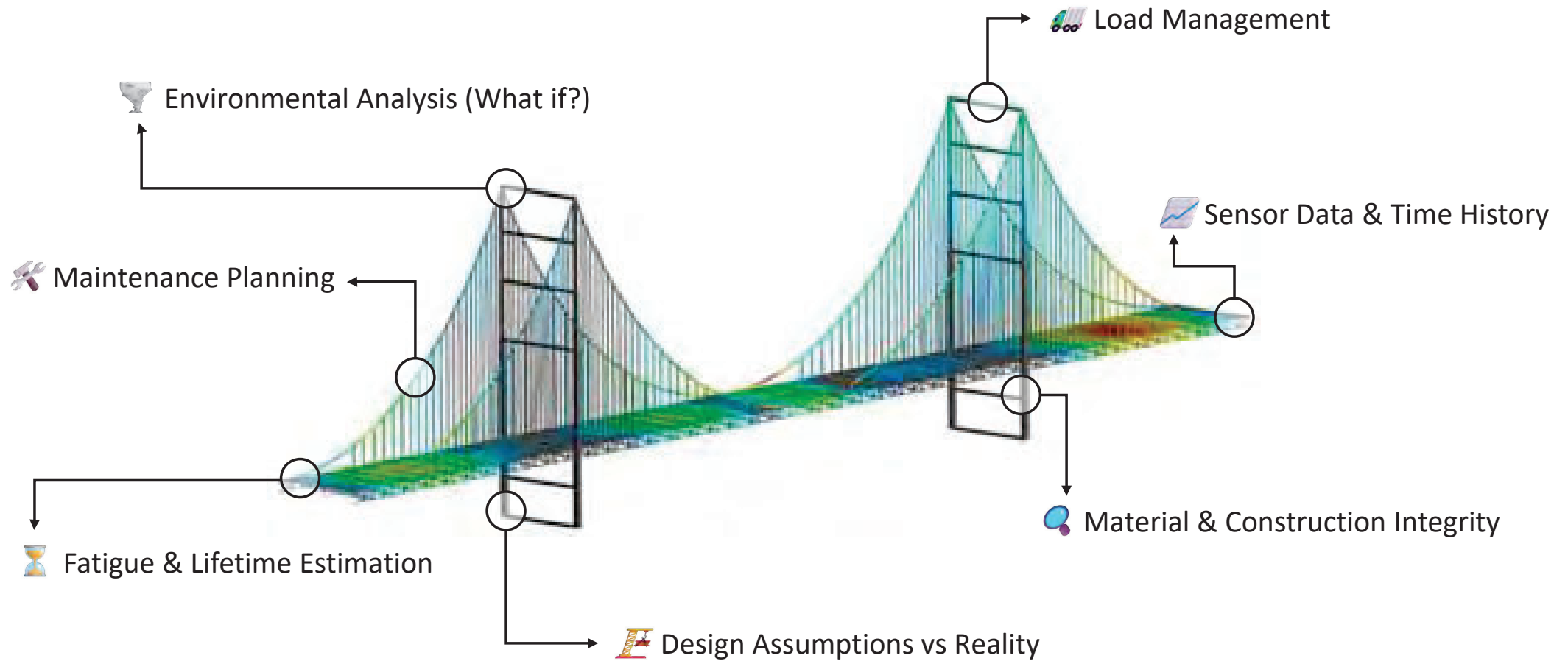


A *Structural* Twin

to translate real-time sensor data into results on creep, fatigue, and life — characterizing preventative maintenance.



Application to Civil Engineering

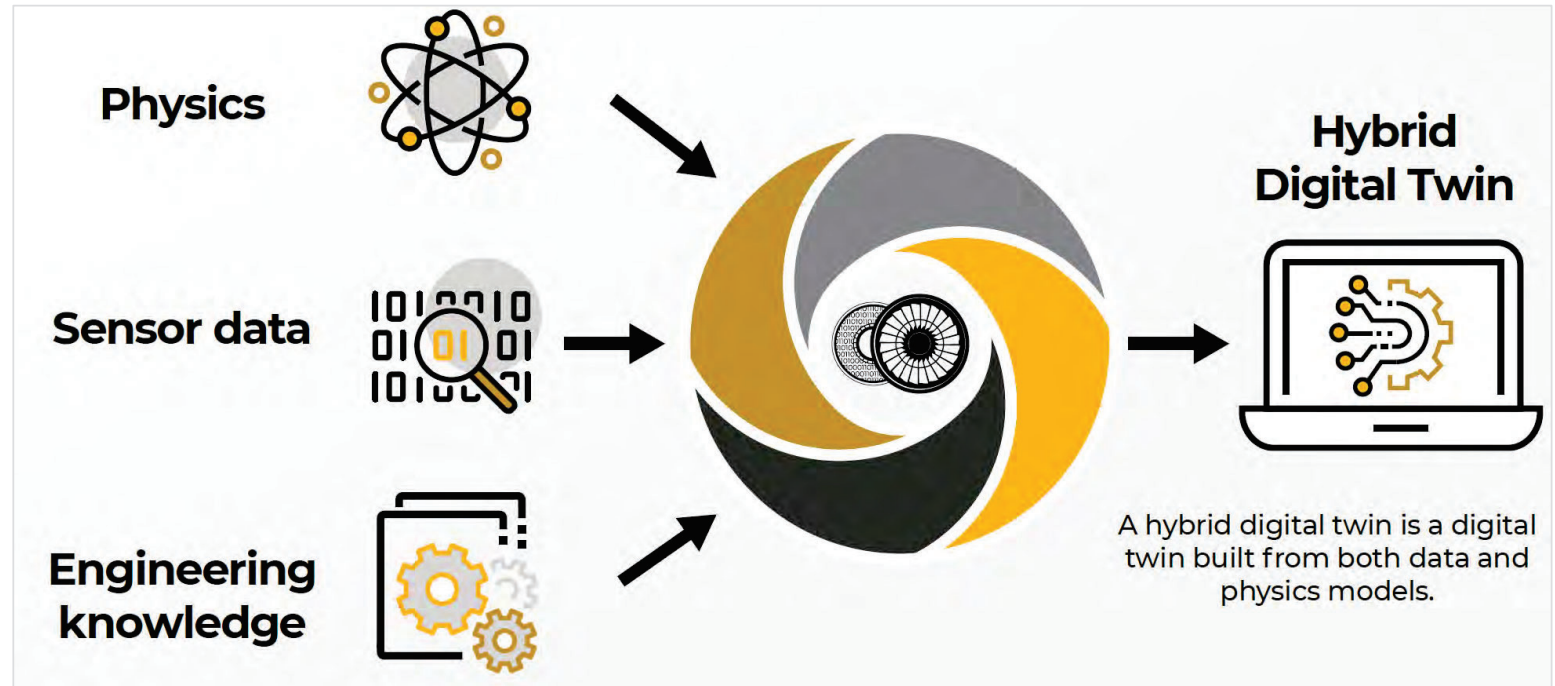


Hybrid Digital Twins: Leverage Models + Data



“Virtual representation of real-world entities and processes, synchronized at a specified frequency and fidelity”

Customer Value: Track the past, provide deeper insights into the present, predict and influence future behavior



A Hybrid Digital Twin is a Digital Twin built from both data and physics models

Digital Twins – Are they just noise?

ARTC: Structural Health Monitoring of Bridges (ETG-09-04)

“Enabling a Digital Twin (DT) perspective for important bridges can be crucial for safety and operative reasons to allow for optimised condition-based and predictive maintenance practices, inspection, and management planning throughout bridge’s lifecycle health”

ARTC

Division / Business Unit: Safety and Systems
Function: Track & Civil
Document Type: Guidelines

Structural Health Monitoring of Bridges

ETG-09-04

1. Ideal Hybrid SHM of Railway Bridges

2. Digital Twin Lifecycle Management Tool

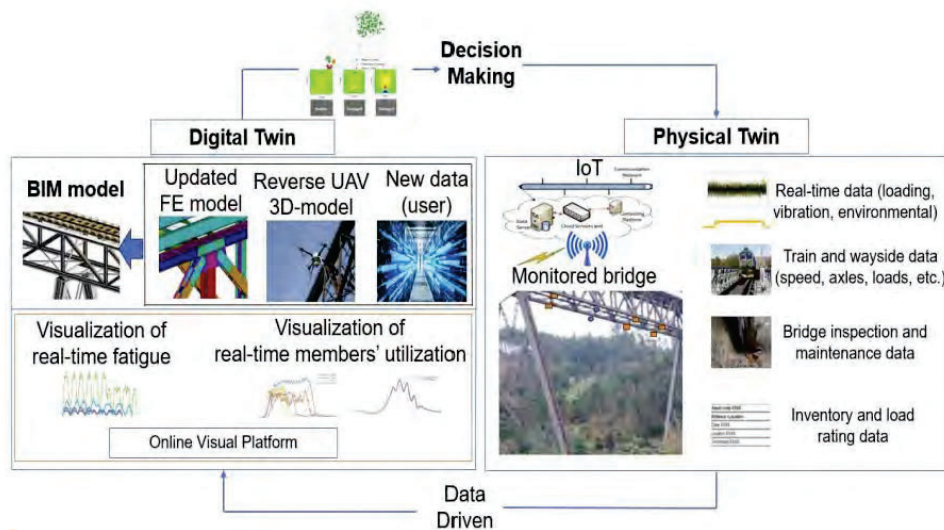
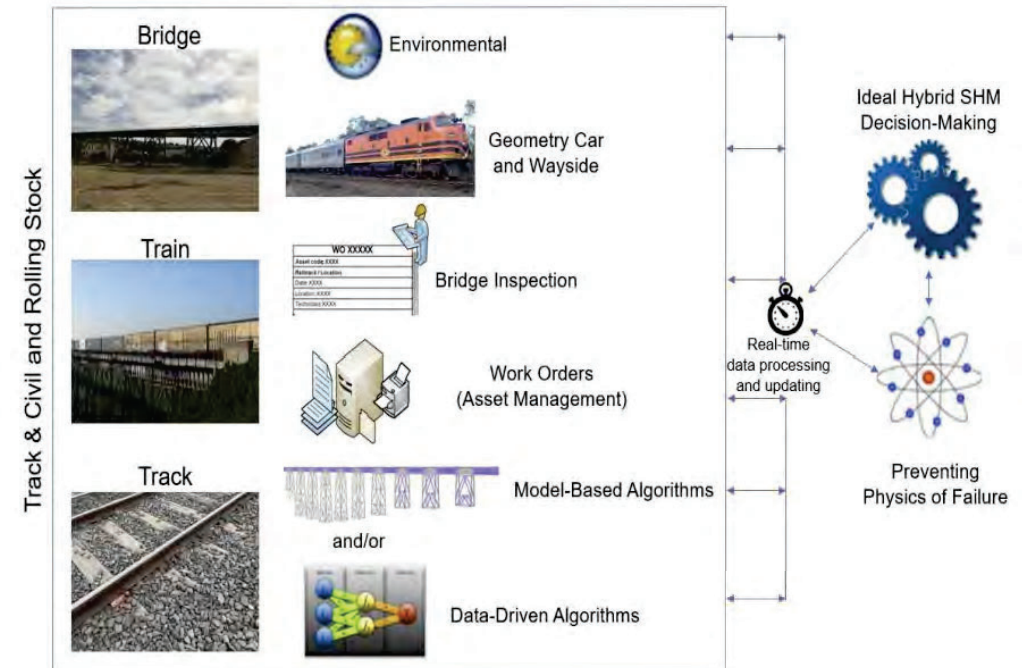
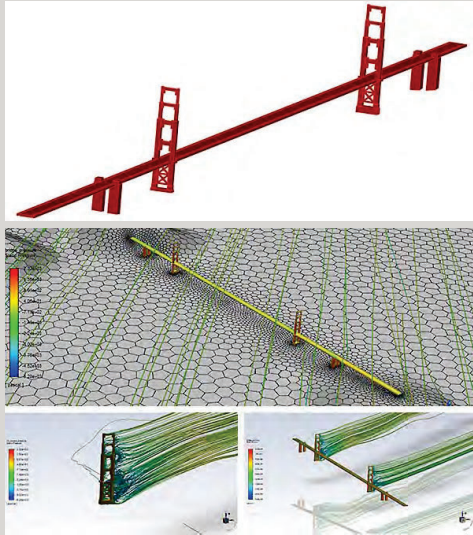


Figure 6: A simple illustration of a closed-loop DT-enhanced BIM management tool



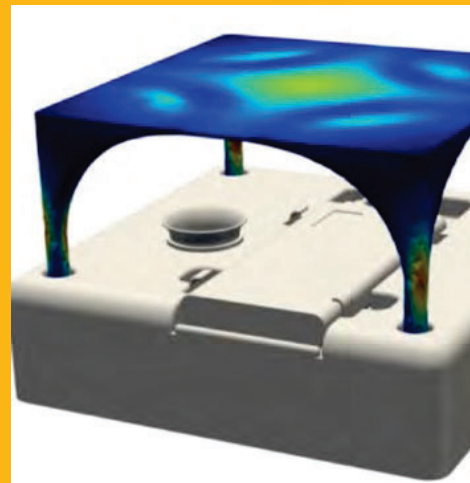
<https://extranet.artc.com.au/docs/eng/track-civil/guidelines/structures/ETG-09-04.pdf>

Digital Twin – Case Studies



Golden Gate Bridge

- Fundamental building blocks
- Geometry, Solving & Building Reduced Order Models (ROMs)



Sensor Monitoring

- Fixed structure with loads measured at discrete points.
- What are critical locations?
- What stresses occur at those locations?



Applications

- VERBUND Hydro Power GmbH
- Predictive Maintenance on Melting Furnace With Digital Twins
- University of Melbourne

*All Data is Notional

Case Study #1 – Golden Gate Bridge



By the numbers:

- **8,980-ft.** long
- **746-ft.** high
- **90-ft.** wide
- **4,200 ft.** is the longest span
- **4 years** to construct
- **372-ft deep water** at the center of the channel
- **1.2 million rivets** hold the bridge's two towers together
- **> \$35 million** in construction costs

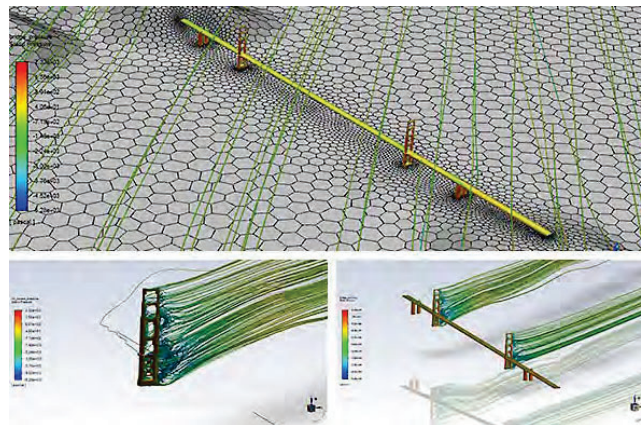
Geometry & Meshing

Creating a geometry of not just the bridge, but the surrounding landscape



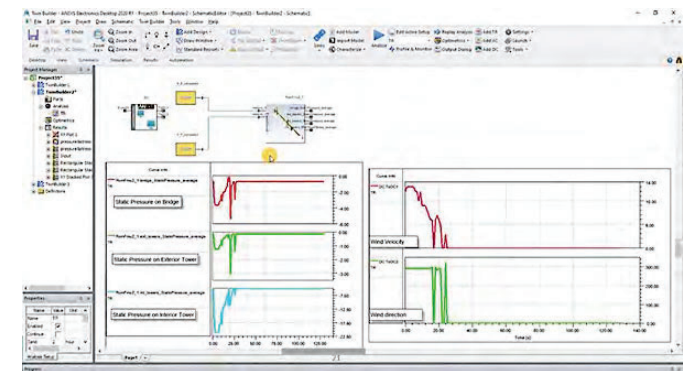
Solving

ANSYS CFD and FEA solvers

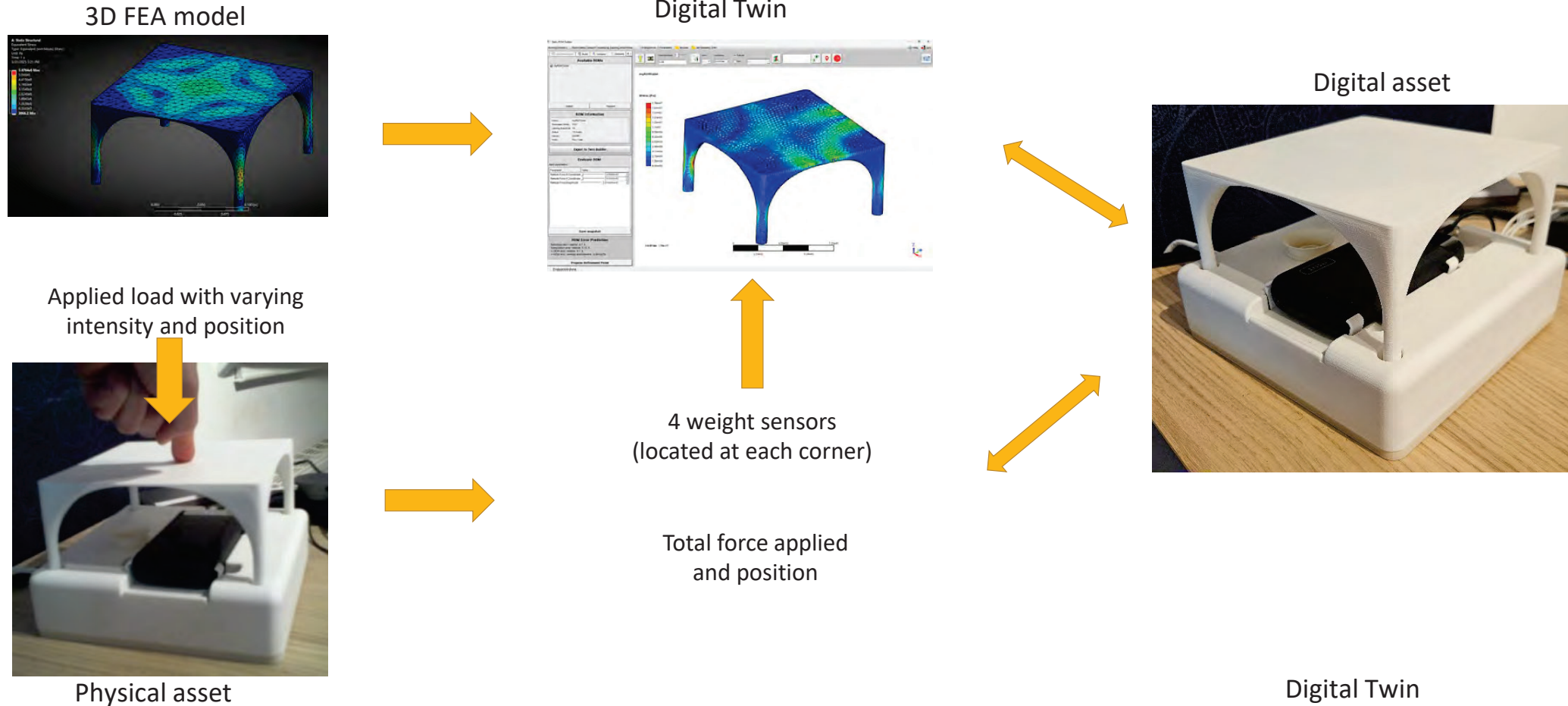


Reduced Order Model (ROM)

Predict results when different inputs are used



/ Case Study #2 – Sensor Monitoring



Digital Twin



Case Study #2 – Sensor Monitoring

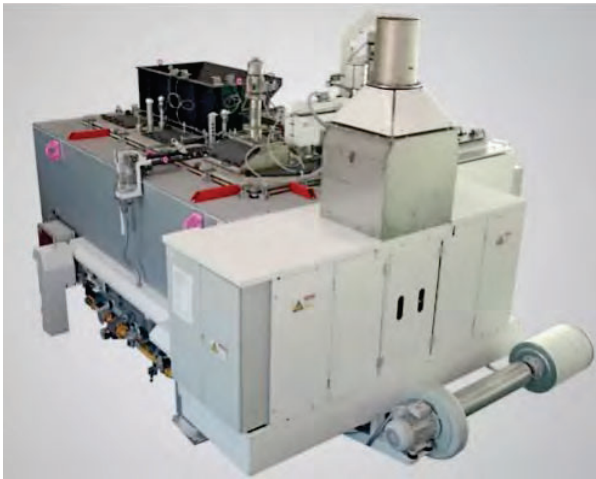
Case Study #3 - VERBUND Hydro Power GmbH: Digital twin looks ahead



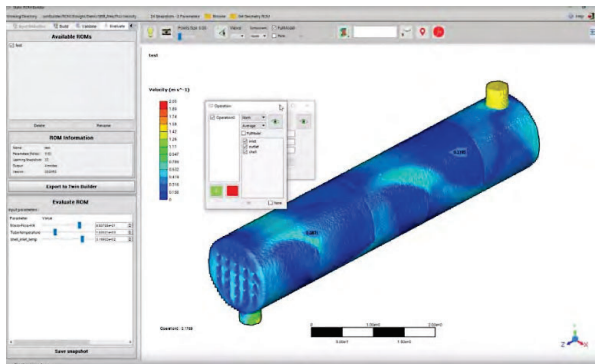
“This process of asking ‘**what if X happens**’ can provide us with **greater insight** into how to operate the system in a system-friendly way or what it means for the service life if the system is operated under very high loads.”

Dipl.-Ing. Michael Artmann, Project Manager for the “Digital Twin” subproject at Hydro Power GmbH

Case Study #4 - Predictive Maintenance on Melting Furnace With Digital Twins



Last year, with the help of CADFEM, RAUCH integrated Ansys simulation software to develop a predictive maintenance approach. By adopting Ansys' digital twin technology and structural, fluids, and optimization software, **RAUCH reduced the risk of furnace failure by digitally monitoring the crucible.**



*"In 2030, we should be able to transform every kind of data into assets for our customers and our own business. **The digital twin is a large step forward.**"*

— Florian Sipek, head of research and development, RAUCH



Case Study #5 - University of Melbourne

Dynamic, real-time tool for bridge monitoring integrating:

- IoT sensor data:
- Geometric models:
- Physics-based simulations:

The Victorian Bridge, Melbourne

Key component of one of
Victoria's most ambitious rail
construction projects



New South Wales Bridge

Iconic heritage structure
within Australia's rail network

[Digital Twin Platform for Structural Health Monitoring\(2024-2025\)](https://eng.unimelb.edu.au/csdila/research/archive/digital-twin/digital-twin-platform-for-structural-health-monitoring)



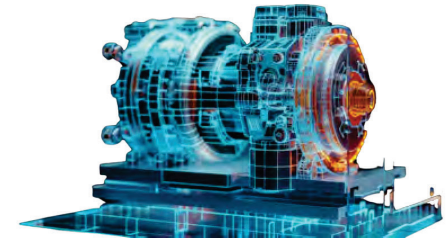
<https://eng.unimelb.edu.au/csdila/research/archive/digital-twin/digital-twin-platform-for-structural-health-monitoring>

Digital Twin Challenges & Insights



Challenge

Companies face challenges in managing the complexity of systems, minimizing downtime, and **responding swiftly to changing conditions**, all while ensuring cost-efficiency and maintaining high performance standards.



Turning Data into Actionable Insights

Companies gather vast sensor data but struggle to turn it into predictive insights. Data-only models may lack accuracy beyond trained scenarios and struggle to explain system behavior.

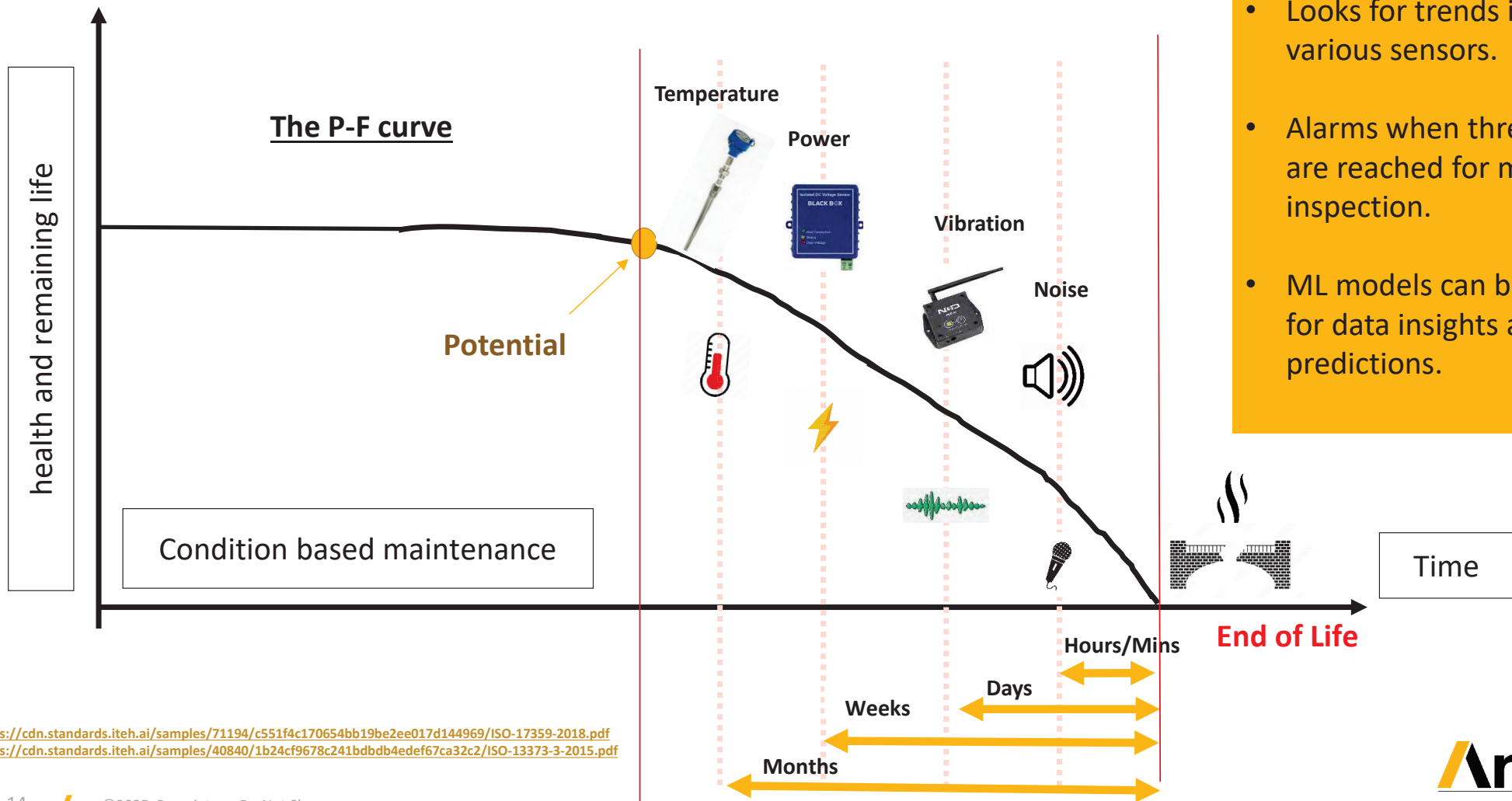
Scaling and Repeatability

Many organizations struggle to move from pilot projects to production-scale deployment of digital twins, often due to complexity, lack of standardization, and performance limitations.

Change & Trust

Combining legacy SHM systems with modern digital twin platforms often requires custom integration.

Summary: Why Implement Digital Twins?



- Looks for trends in data for various sensors.
- Alarms when thresholds are reached for manual inspection.
- ML models can be trained for data insights and predictions.

<https://cdn.standards.iteh.ai/samples/71194/c551f4c170654bb19be2ee017d144969/ISO-17359-2018.pdf>
<https://cdn.standards.iteh.ai/samples/40840/1b24cf9678c241bdbb4edef67ca32c2/ISO-13373-3-2015.pdf>

Who is Leap Australia?

Trusted Ansys Partner

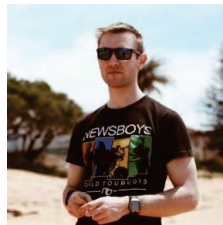
- Founded in 1996
- 50+ staff and 6 offices
- Trusted partner with thousands of clients, including 95% of all tertiary institutions

Technically Focused

- Committed to delivering best-in-class software solutions
 - Training
 - Technical support
 - Consulting



Rhys Young
Engineering Solution Manager
Rhys.Young@leapaust.com.au



Jonathon McMullan
Technical Manager (EBU)
Jonathon.McMullan@leapaust.com.au

