Introduction to NDE 4.0

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Contents

Abstract

Cyber technologies are offering new horizons for quality control in manufacturing and safety assurance of physical assets in service. The line between

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non-destructive evaluation (NDE) and Industry 4.0 is getting blurred since both are sensory data-driven domains. This multidisciplinary approach has led to the emergence of a new capability: NDE 4.0. The NDE community is coming together once again to define the purpose, chart the process, and address the adoption of emerging technologies. This handbook is an effort in that direction.

In this chapter, the authors define the industrial revolutions and technologies driving the change, use that context to understand the revolutions in NDE, leading up to the definition of NDE 4.0. In the second part of this chapter, authors have proposed several value propositions or use cases under "*NDE for Industry 4.0*" and "*Industry 4.0 for NDE*" leading to clarity of purpose for NDE 4.0 – enhanced safety and economic value for stakeholders within the NDE eco-system.

Keywords

NDE 4.0 · Use cases · Value proposition · Future of NDE · NDT 4.0 · Industry 4.0 · Digital Twin · IIoT · OPC UA · Ontology · Semantic Interoperability · Industrial Revolutions

Summary

The world of NDE is about to change, radically, for the better. The suite of digital technologies shows multiple opportunities and strong use cases, like the use of the emerging digital technologies for NDE and the new possibilities for inspection control (Industry 4.0 for NDE) or the integration of NDE as a data source and enabler for Industry 4.0 (NDE for Industry 4.0).

All the use cases identified show that Industry and NDE are growing together with the fourth revolution and will eventually lead to an improved awareness about NDE. This will help increase visibility and value perception of NDE.

There is still a long way to go. When the barriers to digital communication are lowered, proprietary data formats and interfaces are replaced, and semantic interoperability becomes natural; then it will be possible to combine the emerging technologies into new cyber-physical inspection equipment. It will be possible to connect equipment from different manufacturers and analyze big data for safety and quality. It will enable manufacturers to focus on their core-knowledge resulting in rapidly improving products and superior services.

Given the challenges and opportunities, NDE 4.0 needs collaboration on an international scale, without burdens or old structures. Ideas like NDE-manufacturer based clouds are the use of emerging technologies for maintaining the old structures. This eventually may not work. Opening up, collaboration, and the willingness to innovate are key to NDE 4.0 and will decide the future of individual companies and of the NDE sector in general.

If taken on thoughtfully, NDE 4.0 will lead to a completely new way of sustaining product quality and safety, a new way of doing business, a new market for data – an ecosystem with huge potential for purposeful NDE. The journey will have challenges and how the community comes together to pursue it is the purpose of the present handbook.

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