Implementation of NDT4.0 for Ultrasonic Inspection Applications

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NDT4.0 is typically defined as an integrated network of wireless sensors, cloud data storage and processing, smart data interpretation, and automated decision-making machines, with the purpose of streamlining, as much as possible, Non-Destructive Testing processes and reduce human intervention. However, the road to implement NDT4.0 depends on the type of application and which NDT technique(s) are involved in it. In this paper we discuss the implementation of NDT4.0 for application in the ultrasonic inspection of jet engine components during the manufacturing process. This process requires the development of different building blocks such as Robotic controllers, Advanced and Effective Electronic Communications, Advanced Phased Array Electronics with Full Matrix Capture and Total Focusing Methods (TFM/FMC) capability, Integrated Software to control the inspection process, and Machine Learning and Artificial Intelligence algorithms for automated data analysis and pass/fail decision making. An important aspect of these building blocks is that they were originally developed or integrated as key components of different inspection applications at Mistras. The Robotics controller was developed for integrating articulated mechanical arms in composite parts inspection using non-contact Ultrasonics; TFM/FMC was integrated to increase inspection speed in immersion ultrasonic systems, and the Advanced Electronic communications were developed for communicating with mechanical crawlers for ultrasonic corrosion mapping of pressure vessels. The paper will also discuss how to integrate some of the building blocks in the systems described, in order to make them function under MISTRAS NDT4.0.