High Speed TFM-based Method for Titanium and Nickel Billet Inspection

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Titanium and nickel alloys are commonly used in the aerospace industry, particularly rotating parts for jet engines. The stock material provided for the forging process is in the form of a billet, and a vital requirement for flight safety is for the billet to undergo a non-destructive testing (NDT) method based on Ultrasound. Most of these billets are inspected with a conventional ultrasound approach using a series of focused single-crystal transducers. There are a few approaches to this technique in the current industry. However, with the emergence of Phased Array transducers, and now even synthetic focusing techniques like TFM (Total Focusing Method), Phase Coherence Imaging (PCI) and Plane Wave Imaging (PWI), and adaptive surface image correction there is a possibility to improve the billet inspection compared to what is currently done. We propose a TFM-based method to improve inspection speed, sensitivity, and characterization. TFM is now well known in the NDT industry and is now quite accepted as providing excellent resolution. On the other hand, TFM is often thought of as a very slow and time-consuming technique. However, we will discuss how the usage of plane waves, readily available GPU (graphic processing unit) and fast data rate speeds of electronics can bring significant productivity time savings without sacrificing sensitivity and the quality of inspection. Furthermore, access to raw data opens the door to signal processing methods that aid in data analysis, which can reduce false positives during inspection and improve characterization.