QUALITY CONTROL PROCESS TO DETECT THE ANOMALIES DURING LASER SURFACE HEATTREATMENT

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Talens together with its R&D team have developed a novel algorithm to detect the anomalies during a laser surface heat treatment process recorded using a high-speed thermal camera. This new approach detects the anomalies by tracking the movement of the laser spot performing an in-process classification system. Anomaly detection is a key step for ensuring the production of high-quality products in industry.

To successfully apply the laser heating process, the laser beam should inject energy into the surface of the workpiece in a controlled manner. The laser beam moves by following a known pattern that is represented in Fig. 1 However, by using the Dynamic spot Software (DSS) [1] the expected pattern is modified whenever the laser beam has to avoid an obstacle, Fig.1. The system is able to detect anomalies during our proprietary laser surface heat treatment process using a high-speed thermal camera at 1000 frames per second (fps). For this reason, the algorithm models the normal behavior of a system, and then computes an anomaly score for each workpiece below 1s, enough time to manage the extraction of the faulty product from the production line to inspection.

The system detects the anomalies in the laser heating process by identifying unusual laser spot movements. For this reason and because the algorithm relies on a combination of Kernel Density Estimation (KDE) models, we call this approach: KDE-anomaly movement detector (KDE-AMD). If the laser spot movement deviates significantly from the expected pattern, the workpiece can be considered as anomalous. To define the expected pattern, a model of the process evolution is learned with the training data (containing the normal behavior of the process). In this case, the model considers the spatio-temporal characteristics of the laser heating process by learning the expected movements of the laser in different spatial regions and temporal moments, Fig.2. We trained our model using real data provided by a company related to the automotive sector

With the advent of this development, the laser heat treatment of complicated geometries and high added value components is considered to be on the way to becoming a conceptually improved industrial standard.

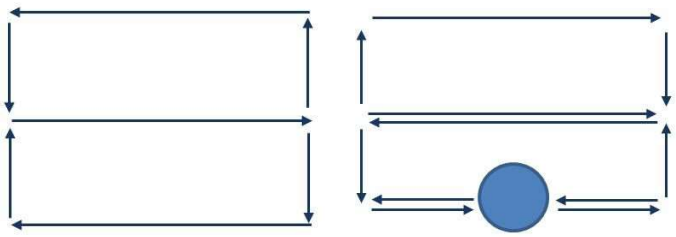

Figure 1. laser spot pattern (a) and modified patterns when the laser beam avoid an obstacle (b).

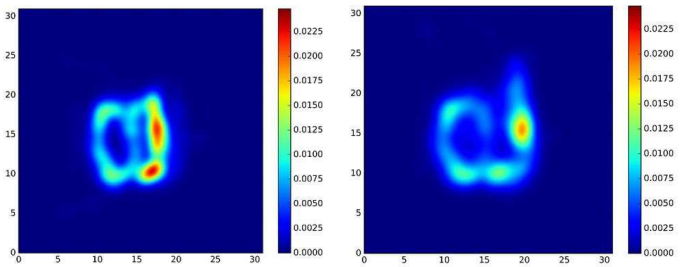

Figure 2. Original pattern (a) and pattern with anomalies detected (b). Red color shows the probability of position of the laser beam.

[1] "Dynamic Control of Laser Beam Shape for Heat Treatment". 36th International Congress on Applications of Lasers & Electro-Optics (ICALEO®

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