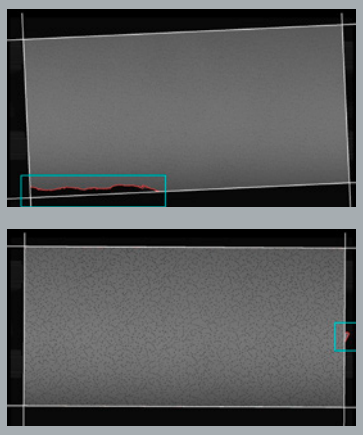
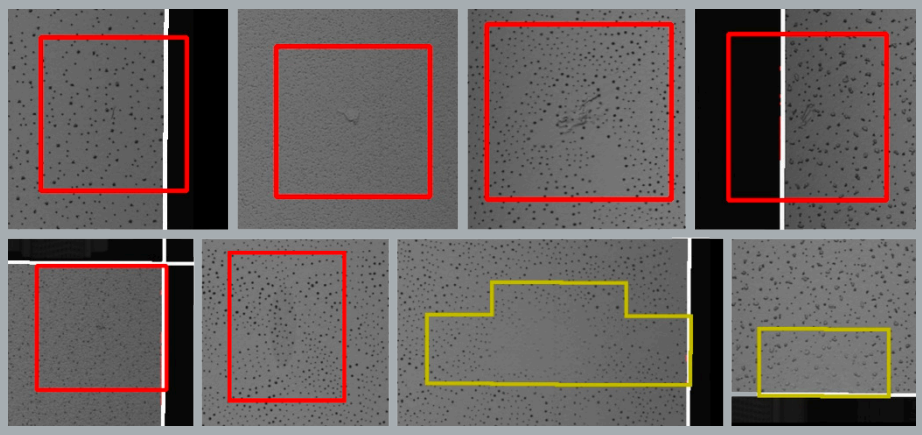


1



2

MODEL-BASED LEARNING FOR THE INSPECTION OF MINERAL FIBER PANELS

1 *Ceiling panels with detected edges: Typical geometric errors are edge break-offs (top) and overhangs (bottom).*

2 *Examples of surface detail defects and large area design errors in the manufacture of ceiling panels*

Model-based learning facilitates fast and flexible image processing solutions. We have developed and implemented such a solution for the Odenwald Faserplattenwerk GmbH (OWA) to provide fully automated testing in the manufacture of soundproofing ceiling panels. OWA mineral fiber panels come in a variety of different designs that are continuously extended. The aim of our solution is to ensure a quality inspection that is so flexible that it can be adapted to new designs and defect types with a minimum of effort.

Defect detection by combining a series of filter processes with morphological methods in a step by step method is difficult to adapt. We avoid this by exploiting the advantages of model-based learning. In effect, this means that we make model assumptions that generically apply to different types of products and combine them with self-learning techniques. Typical industrial applications mainly produce defect-free parts, so examples of the defects are infrequent. Instead of modeling defects, we use a so-called one-class classification of defect-free parts. Any areas whose properties cannot be assigned to this good class are then identified as defects.

Algorithm finds large-area and small-scale defects

First, we model the rectangular shape of the ceiling panels by detecting the main lines with the aid of the Hough transformation method. In this way, dimensions are determined and the first defect types can be found. To look for defects inside a panel, we model the design or even the needling. We find defects in large areas and also in small details. In the case of large-area defects, we calculate properties across the entire panel width: for small-scale defects, we use just the properties in the vicinity of the needling. For both types of defects, learning is based on a sufficiently large number of sample images classified as defect-free panels. Already a hundred images are sufficient to enable this classification to work productively with little parameterization effort.

By means of this combination of procedures, we quickly provide a good solution for the production of new product variants, which we can also iteratively improve during a running operation with the addition of more sample images.