NEW MACHINE VISION SYSTEM FOR THE QUALITY INSPECTION OF STRUCTURED 3D-FREEFORM COMPONENTS AND HAPTIC SURFACE MEASUREMENT

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The present work aimed at machine learning (deep learning) aided inspection of 3D-shaped polymer components. In particular, new developments of self-learning inspection methodologies are presented, which are capable to detect defects on free-shaped and structured surfaces for the very first time. Quality inspection of 3D-shaped parts with varying surface morphology is a complex task and therefore full inspection systems are not yet existent at the market. Machine vision systems have to distinguish between allowed part-to-part variations from not allowed (defect-) structures. This process need to work self-intelligent, automatically and reliably during production. For this reason algorithms are required that are capable to adapt themselves to allowed part-to-part variations in a self-learning manner. After full surface detection, defects quantified in correspondence to human´s visual defect perception. At the PCCL new experimental inspection system demonstrators were developed, which are capable to inspect the surface of free form polymer parts entirely. The surfaces are analyzed for defects by new self-intelligent algorithms, which are based on deep learning. As a result, the inspection system can adapt to new surface morphologies from single part to part and it is able to assess detected anomalies according to surface shape and structure conditions automatically. Due to its flexibility concerning possible surface shapes and structures, the inspection system forms a considerable novelty and the interest of the polymer industry is accordingly high.