REINFORCEMENT LEARNING FOR THE OPTIMIZATION OF SURFACE ROUGHNESS IN LASER POWDER BED FUSION

1 Experimental setup for in-situ process monitoring during LPBF.
2 AI-based roughness analysis of LPBF component surfaces.

In the next step, reinforcement learning (RL) is used for the software agent to learn a strategy so that it can set the process parameters for the next component layer. Based on the surface image data evaluated by the CNN, the agent learns how to select process parameters adapted to the situation, a selection that results in the lowest possible surface roughness and a low number of surface defects.

Results

The process has been tested on the basis of real data under laboratory conditions and shows that it successfully improves surface quality while needing only a few layer-by-layer parameter adjustments. In further investigations, Fraunhofer ILT will examine the ability of the system to automatically and continuously adapt the learned parameter strategy to new process situations and target variables.

Applications

The method can basically be transferred to other machining processes and also used to optimize as well as control a process in real-time if the measurement technology is adapted accordingly.

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