Online monitoring of the workpiece surface with a sensor integrated end-milling tool

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Abstract

In the case of complex forming tools, the topographical properties of the component surfaces play a crucial role for the later quality of the formed metal sheets. To be able to process the free-form surfaces of these components, the used end-milling tools need to be long-cantilevered and slender. Today, the characterisation of the component surfaces is carried out downstream and partly by extensive quality investigations. A 100 % inspection of the entire surface is usually not carried out. To be able to investigate the surface properties during machining a sensor integrated end-milling tool has been developed. The significant advantage of this tool is the high sensitivity due to the accelerometer installed close to the tool center point. This scientific paper uses cutting tests to show how the measurement data collected with the developed tool can be used to monitor the surface of the workpiece during the process. Figure. 1 shows the test setup and the machine parameters cutting width a_e, cutting depth a_p, speed n, and feed per tooth f_z. Only the spindle speed was varied for the investigations. After the cutting process, the workpiece surface was measured with an optical measuring system (Alicona Infinite Focus G5). The paper shows the results of the acceleration measurement and the workpiece surface. To establish a correlation between the acceleration data and the surface, characteristic values were developed that allowed a comparison. Furthermore, the paper shows how the characteristic values were used to develop an algorithm that monitors the workpiece surface using the acceleration data from the sensory tool. Finally, examples of the application of the developed algorithm are shown, such as increasing the workpiece quality or the targeted structuring of the workpiece surface.

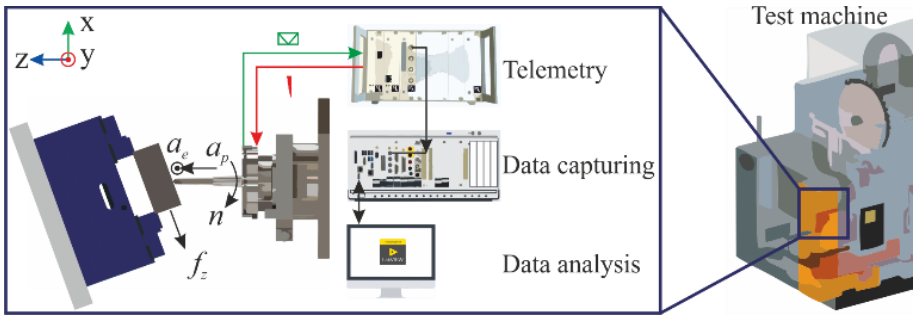

Figure 1: Test setup