

Invited Speaker:
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Presentation Title: “An Integrated-Intelligent Re-manufacturing Process“

Abstract

Fabrication processes, including additive manufacturing, casting, machining and welding produce parts with surface finish imperfections (e.g. build striations, pitting, mill-lines, or weld spatter) and edge burrs/flashing. Various processes are available to remove these imperfections including sanding, grinding, bead blasting, or vibratory polishing. This presentation focuses on the finishing (abrasive grinding process) which is routinely used in aerospace manufacturing industry to remove burrs on the components. Finishing is an important finishing stage in aerospace components manufacturing to achieve the required surface finish quality within its acceptable tolerance. It is critical to have a tight surface finish tolerance for some critical aerospace components to reduce attrition on the component.

At present, the surface quality monitoring is accomplished through offline and/or direct measurement of surface roughness or thickness. In high-volume productions, manual measurement can lead to ergonomic or safety hazards. Also, inconsistency from operator to operator can lead to variations in product quality measurement. In addition, the measurement stage requires a considerable amount of time besides the production process interruption that is caused by the offline measurement. Moreover, in some cases, for measurement purpose, the component needs to be detached from the fixture. When the surface quality of the component does not meet the requirement of post processing, e.g. assembly process, it then needs to undergo a further re-manufacturing process. As the aerospace industries look for process changes that would drive down the manufacturing process time, they recognize that in-process sensing solution is a potential tool to respond to the problem. To develop an in-process sensing, appropriate sensors should be taken into account. In this solution, sensors are utilized to find unique signatures that correlate the behavior of the process to the surface finish quality. Accelerometer and acoustic emission (AE) are typical sensors used to characterize a certain manufacturing process based on the signal generated from the abrasive contact between tool and workpiece.