Technical and Economical Comparison of Modern Polishing Technologies

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Industrial partner: Christopher Ward SA, Biel

The watch manufacturer Christopher Ward wants to increase its production capacity to meet the growing demand in the market. The polishing process was identified as a bottleneck and after a technology research, three polishing technologies have been selected for a production improvement. This work results in a procedural and economic comparison of the three polishing technologies with recommendations for action.

Introduction and Objectives

The polishing process at Christopher Ward is a delicate one. The stainless steel and brass parts have a complex geometry, are very small and must be polished zonally. These demands on the polishing process make the process slow and costly. In a preliminary study, more than a dozen alternative polishing technologies were investigated. Three are suitable for Christopher Ward's application: CNC polishing, robotic polishing, and electropolishing. The objective of this thesis is to identify providers in Switzerland for these technologies while investigating their process and economic impacts.

Methods

Process and cost comparison is based on literature findings and on information from major suppliers of polishing technologies of the watch industry. The collected data is used for a process and cost comparison. In the process comparison, factors such as cycle time, quality, and reliability are determined as well as how a process is structured. In the investment and cost analyses, the investment costs, the payback period, and the break-even threshold are determined. In addition, the machine hourly rate (MHR) is calculated. Finally, the results obtained are evaluated in a supplier selection analysis.

Results

CNC polishing is only available as a standard solution. For robotic polishing, there are standard solutions as well as custom solutions. Electropolishing is available as a custom solution and can be outsourced as a service. With CNC polishing and robot polishing, the cycle time is about the same. The standard solution of robot polishing has lower investment costs and a slightly better MHR. The comparison to electropolishing is difficult here since it is not a linear process. As quantities increase, the process become exponentially better. For mass production, this process achieves clearly better unit costs. The dimensions of the piece numbers alone cannot be achieved by the others. However, electropolishing is less suitable for lower quantities due to the zonal requirement, resource, and energy consumption.

Recommendations

The procurement of a standard solution is preferable due to high planning reliability and low risk. A solution with robot polishing as well as with CNC polishing is available. For mass production, electropolishing is the best suited process. Parallel technology procurement is also possible. First, a standard solution can be procured, while electropolishing is introduced later.

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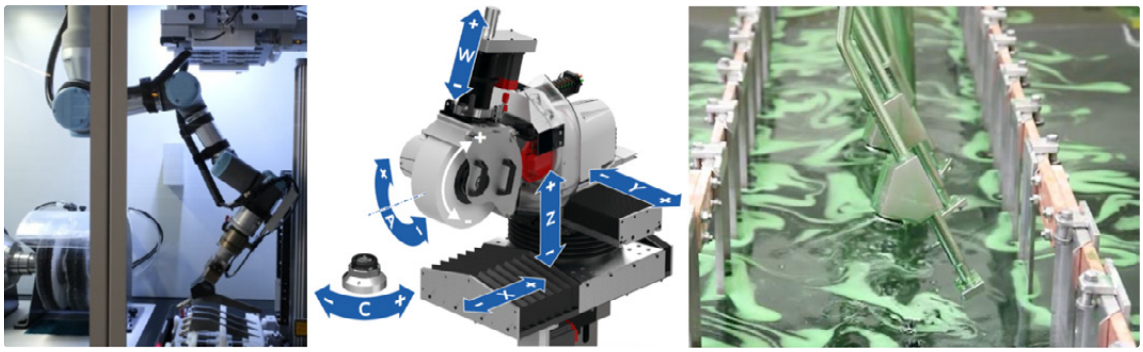

Figure: Visualization of the analysed and compared Polishing Processes - Robot Polishing (l), CNC Polishing (m) and Electropolishing (r).