Study on wheeled polishing technology based on industrial robot

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The experiment chart of tool's removal characteristics

Overview: The early aspherical optical processing relies on manual processing, which has low processing efficiency and great demand for workers with excellent skills. The modern processing technology is a deterministic polishing technique including the numerical control technology and new polishing mechanisms, such as electromagnetics and hydrodynamics polishing techniques. However, those modern polishing techniques are very expensive to buy and use. Considering the rapid development of industrial robot technology and its advantages, such as smaller size, less space occupation, large processing range, capability to meet the component size and shape, and so on, it would be a good way to polish high precision aspherical lens with industrial robot.

Wheeled polishing uses contact flexible buffing wheel to work. When the buffing wheel is pressed against the surface of the workpiece, the contact part of the wheel forms the polishing contact area. The rotating wheel provides the pressure and speed in polishing processing with the help of particles in polishing liquid. The wheeled polisher fits well to the surface of workpiece, even near the edge of the component. This paper aims at how to use the industrial robots and wheel polisher at the end of the robots to fulfill the precision position control and surface polishing.

The wheeled polishing technique based on industrial robot is established by combining the advantages of robot control and wheeled polishing technology. The feasibility of wheeled polishing tool in high-precision polishing processing is demonstrated by using numerical simulation. The residual error of the surface within 95% aperture is less than RMS 0.02λ, which meets the demand for high precision polishing. The wheeled polishing tool is designed and installed at the end of the robot. Two types of polishing path are researched. Pressure is controlled by the amount of depression of the robot arm and its precise position control. The robot wheeled polishing control logic and framework are analyzed. At last a robot polishing control mode based on trajectory and dwell time is established.

By carrying out the experiments of robot's single-point and belt polishing, the parameters of robot wheeled polishing is confirmed. The surface error decreases from the initial value of PV: 2.357λ (RMS: 0.565λ) to PV: 1.431λ (RMS: 0.242λ) after several cycles of polishing. As the research shows, the industrial robot with wheeled polishing tool is an effective method in high-precision aspherical surface polishing.

Citation: Yang R, Yun Y, Liu Z W, *et al*. Study on wheeled polishing technology based on industrial robot[J]. *Opto-Electronic Engineering*, 2018, **45**(5): 170710

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