Design and manufacture of an AM3DP-based lens manipulator for Continental

LEITAT managing technologies

Email: dembid@leitat.org | **Telf.**:+34 937 882 300 | **Web**: www.leitat.org

Sector: Automotion

Challenge: To develop a light and robust solution for the gripping, handling and placement of the lenses in the hot stamping and assembling process using a cobot.

Solution: Generative design of an integrated lightweight tool and manufactured in polymer with MJF additive technology for use with cobots.

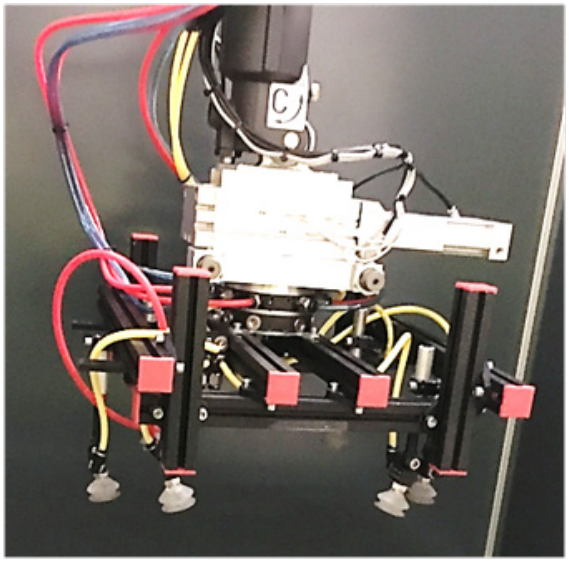
CHALLENGE

The lens reaches the assembling cell by means of a conveyor belt and a robot must place it on the tool where the hot stamping is performed, the lens must be positioned correctly on the tool. Once the hot stamping is done, the robot must take the lens again and place it precisely on top of the mask for assembly.

The vacuum gripping system with a suction cup introduces some gripping errors when making contact with the part. To this we must add the errors that occur when positioning the part by the vision system and the repeatability errors of the robot. During lens manipulation in this process, damage to the lens surface can be caused.

The standard way to solve these errors is by adding a re-gripping station, where the lens is left and the part is centered, always having it in the same position and orientation. In this way, the only errors to take into account are those of the robot and, to a lesser extent, those of the design of the re-gripping station. This increases cycle time, something Continental wanted to avoid.

All this had to be solved with a single light and robust tool that could also be used in a collaborative work cell.



Conventional tool: complex, high weight and inertia, with a large number of components, requires assembly, adjustments and maintenance.

SOLUTION

The design of a device capable of guaranteeing the clamping, positioning and manipulation of the component was carried out, without causing damage to its surface. The most suitable areas and contact surfaces were identified to make a firm hold on the piece. A clamping methodology based on a main contour or edge geometry was established together with a vacuum system using suction cups.

This solution allows the piece to be caught without leaving marks on it and, when picking the piece, it is automatically centered so that the final catch position is always repetitive. This allows maintaining the cycle time while allowing a correct manipulation of the part in the process, even when having to place it inside a tool with high precision.

To optimize the process, 3D printing technology was used and a design was made in which, when picking up the lens it self-centers, thus eliminating the need for a re-station and obtaining a shorter cycle time.

A light and robust connection structure with the robot was designed capable of supporting the vacuum channels and the component clamping geometry. This structure was generated taking advantage of 3D printing and self-supporting generative structures, giving the model the desired rigidity and flexibility.

Resulting tool designed for additive manufacturing with vacuum channels integrated in the structure and made of polymer with MJF.

BENEFITS

Simpler solution with a functional design without the need for calibrations. Greater robustness and productive reliability with minimal maintenance, easier connection and control. Cycle time has been reduced, resulting in savings equivalent to more than 2,000 hours. The volume of parts discarded due to damage during product handling has been reduced by 2%.

Usable with collaborative robots and with lower load capacity due to significant reduction in weight and inertia. Increased station productivity, allowing two lenses to be manipulated at the same time, thanks to the incorporation of a shunt or bridge element. Also designed and manufactured using 3D printing.

The tool has a vacuum channel system integrated into the geometry, being part of its structure, guaranteeing the correct and precise positioning of the suction cups throughout the lifetime of the solution.

It also has a self-centering edge that copies the boundary geometry of the lens to absorb the inaccuracies of the vision system and the suction cups. The same geometry or edge allows the lens to be manipulated without causing damage or scratches on its surface.

- Tool designed and customized for the application.
- Integration of functions in the design.
- Monoblock part without assembly, addition of suction cups.
- 100% tight vacuum channels, without the need for post processing.
- Reduction of weight and, therefore, inertia (230g per mask + 210g for the bridge).
- Reduction in the number of pieces.
- Elimination of assemblies, adjustments and calibrations.
- Reduction of manufacturing and marketing time.
- Reduction in manufacturing cost.
- Plug and play solution.
- Parameterizable model for use in other similar products and stations.

Manipulator solution with two tools, implemented in a collaborative UR10 robot to increase process productivity