Jenoptik Votan BIM Laser cutting of metals and plastics

Markus Remm
Product Manager Jenoptik Automotive North America

Abstract

To support the trend for higher Automation, Jenoptik created a flexible production line layout to optimize footprint and reduce operator dependence for cutting and welding on press hardened steel automotive body parts.

The concept description is for a system to automatically trim and assemble a structural body part made from press hardened steel (also known as hot stamped steel or hot press forming). Variations of the approach can be applied for any current geometry body part. Material changes to Hydro formed tubing, aluminum body panels, castings as well as plastic assemblies like fascia are also possible within the concept.

Various production stations can be connected in this system to tailor a line consisting of laser cutting, machining centers, accumulation conveyors, rivet systems, spot weld station, etc.

Cutting/ Trimming

The first operation in the production line for a LHD/ RHD body part line includes laser cutting in a Multi BIM cell. In this cell, 4 laser cutting robot with BIM technology (Beam in Motion) trim the outer circumference and multiple holes up to a tolerance of +/- 50µm.

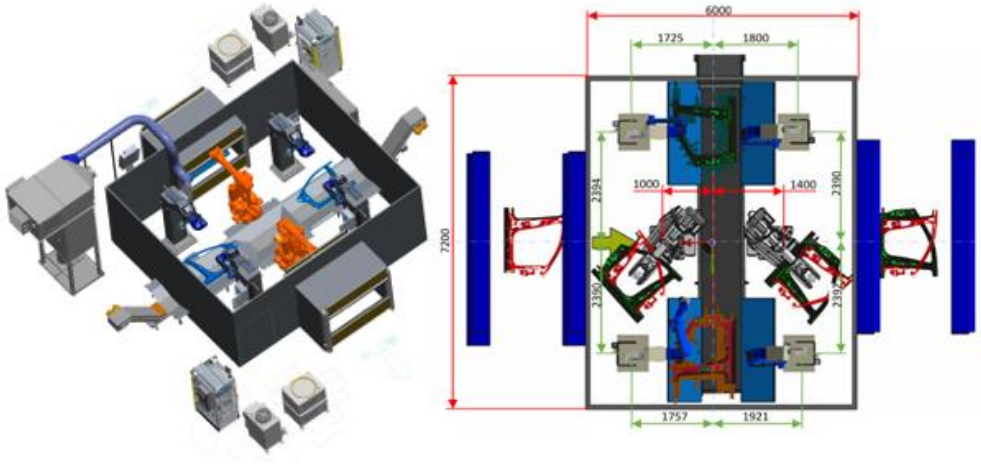

Figure 1 Door Ring laser cutting system

The production flow of this cutting cell is a “through the cell” design. A handling robot with part specific End Effector moves the part from a rack system with vision to a preloading station.

A dual hatch setup for laser safety opens on the inner side of the cell once the outer hatch closes. An internal handling robot takes the part in cut position 1 or 2, depending on utilization. Each cut station is equipped

with 2 BIM cutting robots with 3kW fiber laser power each. The robots perform job specific requests for trimming outer edges, inner contours and a multitude of different sized and toleranced holes.

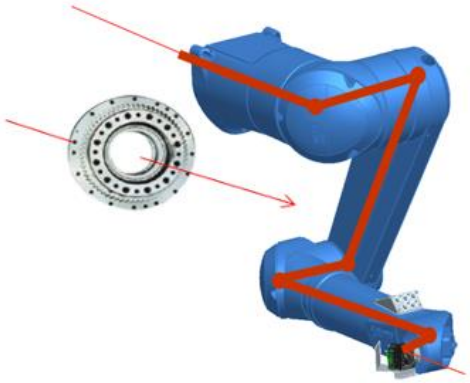

Figure 2 VOTAN BIM Cutting Robot with internal laser beam delivery system through hollow axis

The cutting robots used on the system are a hollow arm design holding tolerances on the cutting of ±50µm.

The fiber laser beam is delivered to the base of the robot and interfaces through a collimator into axis 1. Through the robot, the beam is delivered via cooled bending mirrors that can be tailored to various wavelength. Due to this, variations of the system for parts requiring CO_2, are also possible (e.g. plastics).

In addition, the robot kinematics have been optimized to allow best in class performance in terms of path accuracy and repeatability to benchmark the results of gantry systems.

Working with multiple BIM robots on one single work object, allows for an increase of production throughput as well as a decrease of production floor space.

Optimization of logistics and reduction of line layout footprint is a result of this new approach to cutting of press hardened steel.

Figure 3 results of BIM Fast Contour cutting

The cutting system can be used anywhere part size allows for the efficient use of multiple cut operations simultaneously on parts that are small enough to fit multiples in the work envelope of a robot. Traditional examples are press hardened steel parts, door rings, A-, B-, C- Pillars as well as cast aluminum parts or hydro formed / CNC bent pipes.

The Multi- BIM cell allows for a highly automated process flow combined with minimal part moving and minimal handling time. The return on invest therefore is maximized by allowing for an optimal laser on time.

The accessibility of the cutting system in the 3-dimensional work envelope of the robot allows for less complex cutting fixture with static elements for higher repeatability.

Adjustments to the cut geometry are easy done through HMI offsets of select contours in car coordinate system.

The initial programming of the contour is done in CAD to CAM conversion through simulation software in direct result to robot programming.

Conclusion

Jenoptik Automotive North America is an automation solutions supplier with a strong emphasis on laser processing. Process innovation and optimization of state of the art setups in close contact with the automotive industry helps our customers deliver better products. Variations of the system can include automated remote laser welding, feeding wire laser welding and laser annealing. In addition, it can also be used for plastic laser welding e.g. for automotive fascia. It can be combined with a logistic system such as AS/RS (Automatic storage and retrieval system) for JIT manufacturing and AGV systems.