

Project Note

Sensor-guided joining of 3-D steel profiles

This project involved a cost-effective and flexible process for creating stable, lightweight metal profile joints that was easy to operate and calculate. Downtime was minimised by doing process set-up offline.

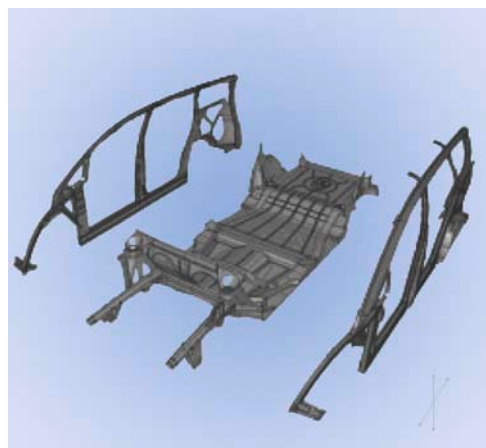
Task

Increasing use is made of frame construction in car production. It is flexible (for small series), stable (for better crash behaviour), and substantially lighter (for lower fuel consumption). To utilise these advantages, ThyssenKrupp Laser-Technik GmbH, Aachen, wanted to join steel profiles using stable laser welds (T-joints), i.e. welds all along the perimeter. Due to the process involved, the part tolerances were too large and the company was not able to comply with the joint gap width of $< 0.1\text{mm}$ allowed for welding. Zühlke's task was to work with Thyssen and devise a process to create bonds of this kind at a reasonable cost despite the imprecision of the parts.

Implementation

Sensor-guided cutting turned out to be the solution. Two sensors measured the actual contour while the robot was moving and relayed the deviation from a virtual set contour online. The laser beam was then diverted efficiently and highly dynamically to the calculated cutting position. In a second pass, the weld was welded with the same laser head travelling along an adapted robot path without filler metal. The path programs for the robot were created and simulated offline using CAD data.

This approach allowed the setup process to be prepared and minimised the downtime in production. Prototype creation in MATLAB with its graphical user guidance struck a good balance between flexibly adaptable architecture, quick implementation of complex mathematics, and acceptable user comfort.



Technical Data

ProEngineer,
MATLAB

RobOffice & ProSim
(Reis Robotics),
XML

Customer benefits

- Cost effective and flexible process for lightweight, stable metal profile joints led to a patent for the customer.
- Derivation of mathematical factors involved ensured a solid basis for the project.
- Easy to operate thanks to graphically guided calculation program.
- Downtime was minimised by doing process preparations offline.
- Coaching of project team during implementation increased the reliability of the outcome.

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