Planning and off-line robot programming system for remote laser welding*

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A current trend in the automotive industry is the application of joining techniques that contribute to lighter car bodies with higher stiffness, increasing at the same time the efficiency of the manufacturing process. An emerging technology is *remote laser welding* (RLW). It joins metal sheets by a laser beam, projected from a scanner mounted on an industrial robot. This enables contactless welding from a distance over one meter. However, due to high investment costs, using RLW is justified only in case of a major reduction in cycle time or cost-per-joint. In industrial practice, robot programming for RLW is still mostly performed by on-line teach-in, which is time consuming and prevents effective optimization.

We propose an off-line programming system for RLW that enables computing close-to-optimal robot programs and provides a complete digital model of the welding operation, hence warrants a first-time-right physical execution of the RLW operation. This requires solving a series of interrelated sub-problems, including task sequencing and path planning (Kovács 2013; 2015), the placement of the workpiece in the workstation; computing the robot inverse kinematics, and the simulation of the welding operation. Finally, the robot program is generated in an automated way. The implemented system has been validated in a case study involving the assembly of a real car door, see Fig. 1. For a detailed presentation of the developed models and algorithms, the reader is referred to (Erdős *et al.* 2015).

References

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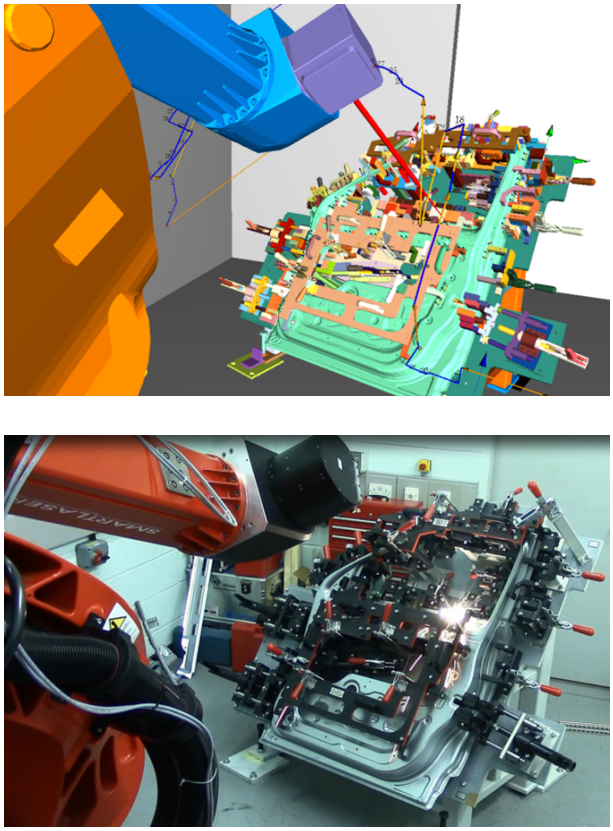

Figure 1: The digital representation of the RLW operation and its physical execution.

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