

Industrial Member Report Summary – Key Findings for Industry

Literature Review on Robotic Friction Stir Welding

TWI Core Research Programme

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Industrial need

Ever since the invention of FSW at TWI, there has been an interest in automation and robotisation of the process as it allows welding of three-dimensional joints with higher flexibility and lower investment cost. However, the high force interactions between the robot and the process make it very challenging to implement FSW on robots.

This literature review identifies the technical barriers and how TWI's core research programme can address them, in order to add FSW to the list of proven joining technologies which can be robotised and automated.

The report focuses on the characteristics of the FSW process and their impact on robot performance and provides an overview of the developments in the field of robotics and robotic FSW. Several opportunities to improve robot accuracy and weld quality are presented as a foundation for the technical work in the core research programme on robotic FSW.



Robotic FSW system at TWI

Key Findings

Based on the review of approximately fifty publications in the area of robotics, robotic FSW and process control of FSW, some technological barriers were identified which restrict the implementation of robotic FSW in the industry. The main findings from this work are:

- The most powerful industrial robots currently on the market still face problems with lack of force and precision. Implementation of force control and robot compliance models allows significant improvement of weld quality and makes the process more robust. New techniques such as stationary shoulder and floating bobbin FSW can reduce the demands on the system.
- Together with increased geometrical complexity of joints and work-pieces, feedback control of the process becomes more important and sometimes necessary. Implementation of temperature control enables adaptation of the heat input in order to maintain consistent weld properties along the joint.
- Multidimensional joint lines require accurate offline path programming, not only for the tool position but also orientation. Unlike arc and spot welding, there is currently no robot software available which accommodates FSW techniques.

How to benefit from this work:

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- If you are not an Industrial Member of TWI, find out how your company could benefit from Membership www.twi-global.com/membership
- Read more: <http://www.twi-global.com/capabilities/joining-technologies/friction-processes/friction-stir-welding/techniques/robotic-friction-stir-welding/>
- Contact Jeroen.DeBacker@twi.co.uk to learn more