Tactile Seam Tracking for Laser Welding and Brazing

by Tom Graham, Key Accounts Group Manager for ABICOR Binzel

One of the biggest hurdles in any automated joining system is the ability to find and track the joint in a consistent nature. Joint quality can be poor due to a number of variables including the standard variance in upstream parts supply or simply poor joint design from either a process or product perspective. Firstly, there is the variation that is inherent in single parts and the overall stack up. As material lots change from one production run to the next along with minor variation resulting from set up, each production run is going to have its own set of idiosyncrasies and variances from part to part which will impact the stability of the joining process. There are numerous ways to combat this sometimes maddening phenomena to stabilize production quality through either high dollar investment in tooling (e.g. stamping or assembly), cycle time increase (e.g. robotic touch sense in arc welding), or using vision packages to help offset robot path to match that of the parts. In the case of the last, this can be very complex to implement and maintain for a multitude of reasons.

A Complicated Process Made Easier

Tactile seam tracking, as applied by Scansonic, uses the actual filler metal to track the joint. Optical paths for these types of optics are set such that the collimation lens (the lens that straightens the beam path as it comes from the fiber) and focal lens (beam is focused to a point providing a tool center point essentially) are separated by a swivel axis. The swivel axis is designed such that the focal lens and associated telescoping arm and wire guiding module stay fixed in relation to the focal lens. Servo motors and encoders control the amount of force applied to the swivel axis, thus providing an inherent level of control to a rotational force between the wire and the joint to be brazed or welded. The most versatile aspect of this application is that the robot can essentially travel a straight path regardless of the part variation. The coordination of the swivel axis, telescoping arm/wire guiding module, and additionally an auto focus feature provides a tool that can accommodate a relatively wide range of parts variation due to the Y rotation of the swivel axis and the Z stroke of the telescoping arm. The auto focus feature is another aspect for ensuring good part quality. This feature allows you to set the spot size at a given tool center point, or 0 point of the Z axis on the telescoping arm.

As the part varies either in Y or Z (assuming travel direction of X), the corresponding position of the telescoping arm can be translated such that the collimation lens moves to match the TA position, ensuring a common spot size. In the case of energy density, variances in spot size will change the amount of energy applied at a given point in the process and could lead to quality issues such as holes in the base metal, pores in the melted material, or uneven edges to the brazed joint.

Aesthetics are typically very critical in brazed joints as the intention is to take these products directly from the process to paint with little to no post finishing. This type of application is especially useful in areas such as deck lids for trunks and roof seams.
The evolution of this technology has enabled car designers to address certain limitations from other processes in the past (e.g. spot and arc welding) providing sleeker body lines and more innovative designs. The window opens even further with the ability to use other materials (e.g. aluminum) enabling aesthetically suitable products that can be applied to other areas of the vehicle. In addition, joint design is not limited to simple fillets or lap joints. Other joint designs capable of being fit to this process include flange butt, reverse flange butt and corner joints.

Outlook on Tactile Seam Tracking

Tactile seam tracking provides the solution to battling parts variance as it positions the tool optimally at the seam joint. Programming complexity and costs reduce dramatically since two path points on the robot are often sufficient and the seam tracking is in charge of making the fine adjustments. Tactile seam tracking offers additional benefits as it is not sensitive to welding spatter or extraneous light, it occurs in real time and does not require time for pre-detection as may be the case with other sensing technologies and with the filler wire serving as the “tactile probe,” wear is not an issue as it is self-regenerating. In order to be competitive in today’s global market, it is imperative to have robust yet flexible processes ... tactile seam tracking is one item that can provide your operations both of these valuable advantages.

About the Author

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