Development of Automatic Path Generating Technology for Spot Welding Robot

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In the welding field of four-wheeled vehicle body equipment, the appearance of new equipment models and updates is accompanied by verification of manufacturability for the purpose of optimally allocating spot welding points in product drawings to each robot in a short time. Development has been pursued with the aim of increasing verification efficiency by the use of robot simulation, and these efforts have contributed to a reduction in total energy expended in new model verification and reduction in on-site teaching labor-hours at new model launches. However, the examination of robot simulation involves large amounts of human labor and may invite the generation of huge numbers of examination hours, depending on the skill and experience of those doing the examination. Validation cannot readily be performed without omissions or oversights within the verification lead time. This paper reports on the development of technology for automatic generation of robot paths that realize highly efficient offline examination without dependence on personnel skills.

Existing processes of verification by means of robot simulation are a mixture of human labor and automation technology. In order to complete verification of feasibility within the lead time for examination before mass production, the labor-hours taken for verification were approximately 2.5 times greater than the target labor-hours. In particular, examination to determine the feasibility of welding gun insertion and retraction for surface changes and for entry and withdrawal paths (IN/OUT) is required to allow for reaching the allocated welding points within the robot's actions without interfering with products or equipment. In addition, it is required to allow for action along paths that satisfy process cycle time requirements without losses. A technology for automatic path generation was therefore developed that uses an action template extracted from mass production machining programs for existing models showing actions without losses combined with the path-finding method using the extraction of interference lines, as shown in Fig.1. The automation of examination that had been dependent on human labor realized a 66% reduction in labor-hours.

The following main functions were developed to address issues in the sequence of feasibility verification processes in addition to the issues described above.

- Static reachability verification function
- Automatic path generation function
- Mutual interference path-correcting function

A highly efficient cycle verification system was introduced that realizes highly efficient digital production preparation incorporating these developed functions.
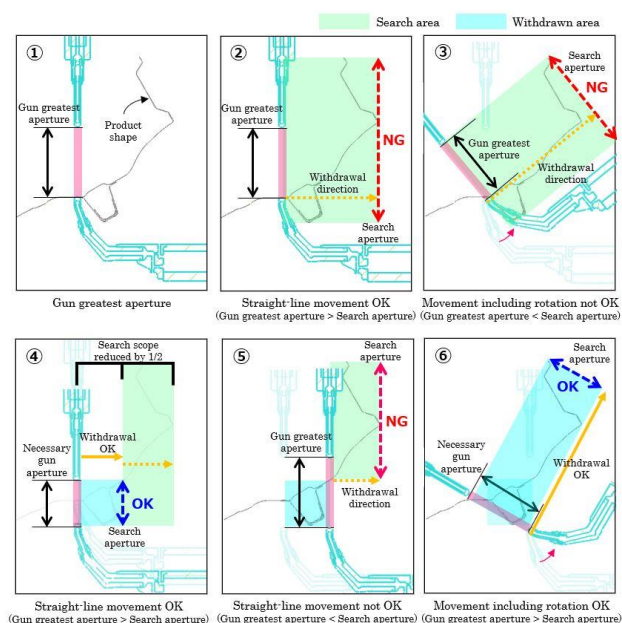

Fig.1 Welding GUN insertion / removal automatic judgment
(2-minute method)