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STRATEGY PLANNING MOTIONS OF THE WORKING BODY OF INDUSTRIAL ROBOTS USING FUZZY LOGIC

One of the most common methods of coloring used in automobile manufacturing with painting the car body elements is electrostatic spraying method. With the technology of lacquer and paint coatings by spraying a constant electrostatic field modern coverage for hardware is created, featuring high strength, aesthetics and economic benefits. This type of painting achieves a better appearance of painted surfaces that increased resistance to aggressive influence of environment. The advantages of powder coating also include:

1. It is possible to achieve a greater thickness of the coating in a single pass, does not require the use of different solvents staining, high corrosion resistance coating;
2. The powder material contains no solvents, no pollution environment by waste during painting; it can ensure better working conditions and health;
3. The use of new technologies such as powder coating, contributes to the high efficiency, suitable for automated production where appropriate and possible reuse of powder;
4. The possible use of thermoplastic powder materials.

There are several factors that limit the application of this method and require considerations when planning operations of electrostatic painting: varnishing and painting properties of the material determined by its physical and mechanical properties (liquid or powder with different chemical composition) which determine the rate of paint, ink spot size, the size of the surface of the painted surface, the area of overlapping layers of paint, etc. surface condition (smoothness and waviness) and form a product that is painted. The second group of factors is technological coating technology, the method of equipment application, preparation of working premises so that due to irrational, inefficient use it leads to uneven coating, poor paint adhesion to the surface, and irregularities on the surface. Another critical element in the organization including powder coating is set for dusting powder as it determines the quality of surface transmitting efficiency, productivity, uninterrupted operation (e.g. breakdown), etc.

In terms of this research it is "typical" to call these surfaces like: horizontal, vertical, flat, curved surfaces, internal and external corners. For different model surfaces we need to use different painting techniques. The shape and surface condition of the product influences on the choice of the trajectory of the working body (WB) of industrial robot (IR) staining.

According to the basic techniques of coating, the trajectory of sprayer staining should pass across the length of the product that is painted, most parallel passages and perpendicular (at right angles) to the surface. Sprayer should always be oriented at right angles to the surface. Spraying should be done by straight uniform motion, moving across the painting in such a way that the torch is cut applied to the previous one, with 50 percent overlap. Failure to comply with these rules will result in uneven coating thickness and its

poor visual display. If the sprayer is too close to the surface that is painted, the paint will be more nebulized, and then it will need to move quickly to prevent clipping paint warps layers. Similarly, if the sprayer is kept too far it can cause excessive dust of painted surfaces.

Strategy planning movement of WB IR provides a rational sequence selecting working areas for selected IR of a specific car body. The working area of each IR divided by the typical surface above, for each of which there is a selected coating technology that provides a number of settings work and trajectory painting.

Body surface is divided into separate areas (work areas robot). Each robot carries dying process within their work area.

The working area of each IR is complex and requires more detailed consideration. Depending on the type of surface using typical coloring scheme is used and it requires compliance with certain technical requirements, the speed of the working body, paint and other feed.

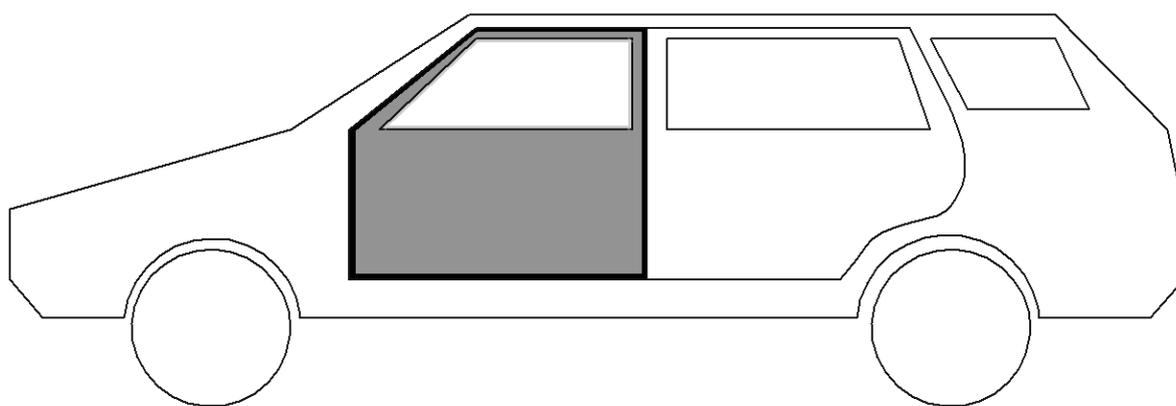


Fig. 1 Conditional division of workspace 3 IR Tell surface

Fig. 1 Item selected for the analysis of the "door" of a particular work area. It is generally divided into 3 types of surfaces:

- №1 - flat surface;
- №2 - outer corner;
- №3 - inside corner;

Further surface treatment will be in accordance with the rules of regulation established by fuzzy switching between bands IR service.

Scheme implementation of fuzzy controller is implemented by using software environment MATLAB/Fuzzy Logic Toolbox. According to the data of the object under study there are the stages of control disturbances formation:

1. Getting input signals, which are:

h1- zone coloring tied to the IR;

x2 - type of surface to be stained;

x3 - WB IR position in Cartesian coordinate system associated with IR: kh_{ro} , u_{ro} , z_{ro} .

2. "Fuzzyfication" data input signals (converting the values to fuzzy type, in the form of linguistic variables);

3. Determination of fuzzy values of the output variables:

u1 - cone course WB h;

u2 - pressure spray gun receiver;

u3 - linear velocity of the spray gun along the equidistant surface of painting;

u4 - component of motion along the x coordinates in the coordinate system of IR;

u5 - component of motion along the coordinates in the coordinate system of IR;

u6 - angle spray gun perpendicular to the main surface of the painting.

4. Fuzzyfication input signals;

5. Formation of productive rules.

6. Realization output mechanism and Defuzzification.

As a result of this work it was analyzed the main stages of the process of electrostatic powder coating and factors affecting the quality of the coating and it was offered the methodology based on the method of determining working areas of IR in a real time using fuzzy logic.