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"A STUDY ON PROCESS OPTIMIZATION FOR LINEAR WELDING PROCESS"

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ABSTRACT

In many of industries, the linear welding process for the silencer is done manually which leads to less accuracy and a time consuming process, Currently Three workers are doing the process and about seventeen minutes are taken, this lead to less productivity and High cost due to labour involvement. This study concern about linear welding process which will takes time when it does manually, this time can be saved through optimizing of techniques like designing fixture for specific job or make atomization of process.

Keyword: *Linear Welding, SPM (Special Purpose Machine)*

I. INTRODUCTION

Modern age is the age of science, with dawn of 18th century industrialization and globalization came into picture. During pre-industrial era the machine were seldom used and almost 80-90% of the operations were performed manually. Thus there was an increase in demand of the products while the supply was less. This led to the use of machine in industries, and industrialization came into existence.

The industrialization also gave rise to the competition, almost all the industries began to use machines, to increase their market share and to reach out to more and more people. With the use of machines, more reliable products were produced, as compared to the conventional manual method. Automobile and manufacturing sector experienced a significant change in the world market. The process which took many days to complete manually can now be completed in few minutes, with the help of automated machines.

For a manufacturing company to remain competitive in today's market, they must produce a quality product at lowest possible cost and in lowest possible time. As we were in search of project, the company offered to perform us a project which will simplify the linear welding process with greater accuracy and at low labour cost. So we decided to make a setup which will weld the side which we are working on as well as it will measure and sense the metal simultaneously avoid wastage of CO2 metal.

II. LITERATURE REVIEW

Arianna Elefante [1] published a paper on **Detecting beam offsets in laser welding of closed-square-butt joints by wavelet analysis of an optical process signal**. Robotized laser beam welding of closed-square-butt joints is sensitive to the positioning of the laser beam with respect to the joint since even a small offset may result in a detrimental lack of sidewall fusion. An evaluation of a system using a photodiode aligned coaxial to the processing laser beam confirms

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the ability to detect variations of the process conditions, such as when there is an evolution of an offset between the laser beam and the joint. Welding with different robot trajectories and with the processing laser operating in both continuous and pulsed mode provided data for this evaluation. The detection method uses wavelet analysis of the photo detector signal that carries information of the process condition revealed by the plasma plume optical emissions during welding. This experimental data have been evaluated offline. The results show the potential of this detection method that is clearly beneficial for the development of a system for welding joint tracking.

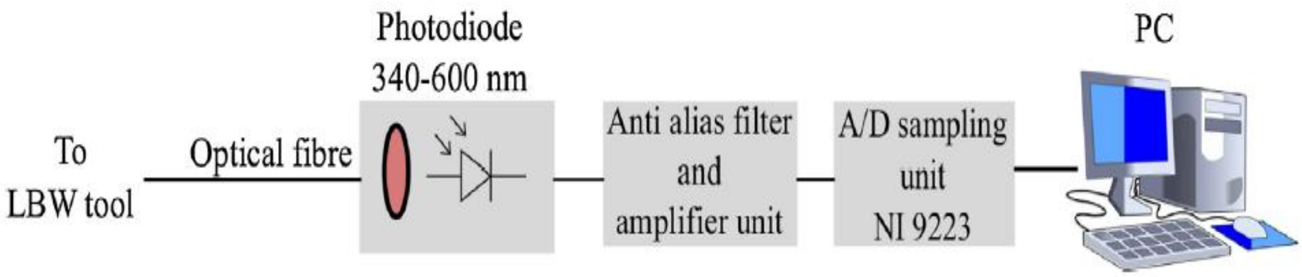

Fig.2.1 Principal of the photodiode system

Jigar D Suthar [2] published a paper on **Design and analysis of fixture for welding an exhaust impeller**. Drum mix plant used for mixing of concrete and other raw materials used in road construction. Impeller is used in the exhaust system of drum mix plant to remove dust particles. Fixture is used in manufacturing of impeller during welding to hold the different parts of the impeller assembly like blades (vanes), upper and lower plates. This paper shows an innovative way to use impeller structure itself as fixture and which has been resulted in the reduction of distortion produced during welding. In this paper modelling work has been done using AutoCAD, Pro-e, Solid Works software, and analysis part has been done using ANSYS workbench. Hence the design and analysis of the fixture has been presented in this paper. Unbalance mass for the impeller has been reduced to 44g for the new design from100g for the existing design.
Fixture has direct impact upon welding quality, productivity and cost. Welding fixtures are used for holding different parts that have to be welded together. Other use of purpose of fixture is to reduce distortion that is generated during welding. It helps in reduction of production loss and also manufacturing lead time for welding, positioning and holding parts. Variety of residual stresses produced while welding are responsible for the distortion.. There are many ways to control the residual stresses namely preheating, peening, post weld heat treatment, stress relief by natural ageing, vibratory stress relief or. The aim of this project is to reduce the distortion in the various parts of impeller namely vanes and upper and lower plates. This ultimately helps in reducing the balancing weight.
Welding residual stresses have an effect on many aspects of the integrity of structures but are normally one of the largest unknown stresses. Residual stresses are difficult to measure and to estimate theoretically but are often significant when compared with the service stresses on which they superimpose. High tensile residual stresses can lead to loss of performance in corrosion, fatigue and fracture.
Impeller used in drum- mix plant for removing dust particles that are produced during mixing of different materials. These particles are necessary to remove from the plant for maintaining proper mixing of materials. Quality of an impeller depends on the fixture used for welding. Thus proper fixture is necessary to manufacture quality impeller.

R.F. Hamade [3] published a paper on **Nondestructive detection of defects in friction stir welded lap joints using computed tomography**. Based on computed tomography (CT), a method is developed for nondestructive detection of defects in friction stir welded (FSW) joints. Plates of AA6061-T6 and AA1050 are welded to produce short lap welds. Utilized is spindle speed of 1600 RPM and fifteen different tool feeds ranging from 25 to 1000 mm/min (dubbed welded cases #1 to #15). These joints are CT-scanned and DICOM images are produced for digitally sectioned zones within the welded joints. To demarcate metallic zones from defects, a threshold cutoff value for Hounsfield Unit (HU) is needed to create 2D segmented masks determining the periphery between metal pixels from air pixels. Otsu's thresholding selection method from grey-level histograms is utilized for this purpose. These cutoff values are found to vary slightly fromonewelded joint to another. Fromthe 2Dmasks, 3D representations of the welded joints revealed the

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shapes, locations, and volumes of the detected defects. Cross-sectioning of welds is employed as a destructive test to corroborate the locations and areas of CT-detected defects. The results of the defect area analysis fromthe CT-scans are compared to the results from optical images obtained by computer vision (CV) in a pixel-based analysis.

Abhishek Das [4] published a paper on **Fixture Design Optimisation Considering Production Batch of Compliant Non-Ideal Sheet Metal Parts.** Fixtures control the position and orientation of parts in an assembly process and thus significantly contribute to process capability that determines production yield and product quality. As a result, a number of approaches were developed to optimise a single- and multi-fixture assembly system with rigid (3-2-1 fixture layout) to deformable parts (N-2-1 fixture layout). These approaches aim at fixture layout optimisation of single ideal parts (as define by CAD model). However, as production yield and product quality are determined based on a production volume of real (non-ideal) parts. Thus, major challenges involving the design of a fixture layout for assembly of sheet metal parts can be enumerated into three categories: (1) non-ideal part consideration to emulate real part; (2) 'N-2-1' locating scheme due to compliant nature of sheet metal parts; and, (3) batch of non-ideal parts to consider the production process error at design stage. This paper presents a new approach to improve the probability of joining feasibility index by determining an N-2-1 fixture layout optimised for a production batch of non-ideal sheet metal parts. The proposed methodology is based on: (i) generation of composite parts to model shape variation within given production batch; (ii) selection of composite assembly representing production batch; (iii) parameterisation of fixture locators; and (iv) calculation of analytical surrogate model linking composite assembly model and fixture locators to probability of joining feasibility index. The analytical surrogate model is, then, utilized to maximize the probability of joining feasibility index starting from initial fixture locator layout. An industrial case study involving assembly process of remote laser welded door assembly illustrates and validates the proposed methodology.

R. Förstmann [5] published a paper on **Design for Automation: The Rapid Fixture Approach**. As product varieties rise and lifecycles shorten, development approaches need to be adapted. Current trends aiming to solve the dissonance of reduced time to market and increased product variety include agile methods. In this context not only product design processes need to be adapted but also development of production processes and manufacturing equipment. At the example of fixture design, this paper presents an approach which allows an agile provision as well as a reconfiguration of equipment. The solution presented consists of a fixture design concept consisting of design rules which allow implementation into a tool for automated fixture design.

Agile product development and prototyping requires tools and methods for the agile provision of production equipment such as load carriers, simple handling or assembly fixtures. Also assembly lines with a high number of variants ask for production equipment which either can be used by all product variants or can be reconfigured in regard to the actual assembly task. Automation of design processes and additive manufacturing are two enablers which allow to quickly generate the regarded design documents and to setup a piece of equipment immediately. For an assembly line this allows a constant reconfiguration of production equipment and tools depending on the product.

Baowei Ma [6] published a paper on **Integration process of stamping for DP600 advanced high strength steel sheets**. The springback behavior of AHSS (Advanced High Strength Steels) is more serious than ordinary mild steels. Currently, deformations due to springback can be compensated by modifying the tool geometry in the industry, which often consumes for a long time. In addition, the stamping parts usually need welding and assembly, and the welded part also has deformation. Therefore, an integrated process combines stamping and welding is presented in this paper, including stamping, placing welding parts and spot welding a total of 3 processes. This paper takes Ω-shaped parts as the object of study. The dynamic explicit method is adopted in the stamping process, and the static implicit method is used for the analysis of the stress release process. The effect of welding location, thickness of welding plate and width of welding plate on geometrical dimension are considered. Finally, the results of finite element analysis is evaluated by the validation experiment. The result shows that the combination of stamping and welding process can effectively reduce the springback value, and the deformation of the stamping part is less than 1mm. After the stress of the welded part is released, the stress on the inner and outer surface of the Ω-shaped part can be greatly reduced along the thickness direction

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Anil Akdogan [7] published a paper on **Investigation of Effects (Welding Sequence, Fixturing, Welding Points) on Distortions after Spot Welding for Determining Individual and Cumulative Tolerances**. The manufacturing and GPS (Geometrical Product Specifications and Verification) have to be thought and analysed together. Welding and Metal Forming are two of manufacturing methods, which are used to create sheet metal parts assembly groups. The dimensions do not stay steady and they change during these two manufacturing methods. Because firstly, after forming (for example bending) the springback and secondly, after welding (for example spot welding) the distortions exist. In this study, the distortions after spot welding are researched and their effects on tolerance chain and assembly tolerances are analysed. These distortions are determined with analysis software after designing some sheet metal part assembly examples. After that, these distortions are achieved with real measurement (scanning) after welding of the sheet parts. At the final step, the analysis and measurement results are compared.

R. Fritzsche [8] published a paper on **Automatic adjustment of car body fixtures using artificial intelligence**. In car-body production, the fixtures used for fixing the car-body panels during the joining pro-cesses predominantly consist of rigid constructions that require a time-consuming manual set-up process. To automate the adjustment process and reduce ramp up times, different adjustment modules have been developed at the Fraunhofer IWU in order to meet specific requirements. Because of high quality requirements, produced components will be checked against an adjustment database. The exactly positioning for each clamping point will be derived, with the aid of mathematical algorithms and modern methods of artificial intelligence, based on measured values and the knowledge of the template technicians. For an efficient and sustainable production process against the backdrop of the increasing number of variants and decreasing in model model cycle times, mechanised and automated fixture components and control processes are necessary. In order to use kinematic systems for automated adjustment and an increase in production flexibility, strict requirements must be fulfilled. In addition to absorbing strong process forces, these requirements include the adjustment times relevant to short cycle times and, in particular, the reproducible accuracy of the adjustment systems for static and dynamic process forces during the clamping and joining processes of the components.

Florian Schlather [9] published a paper on **Process forces during remote laser beam welding and resistance spot welding.** Welding of sheet metal in the automotive industry involves inflexible and expensive joining fixtures to properly position and fasten the parts that are to be joined. Feature-based fixturing is an approach to reduce fixtures in the assembly process. The approach relies on part-inherent fastening features that realize the functions of positioning and fastening. The proper design of these fastening features requires knowledge of forces that result from the joining process and thus need to be compensated. This paper describes the investigation of process forces during remote laser beam welding and during resistance spot welding. This is achieved by using a thermo-mechanical simulation model and experimental studies. The comparison shows significant differences in process forces that result from the two different processes. Finally, the results allow for the design of fastening features to reduce joining fixtures in the automotive body shop.

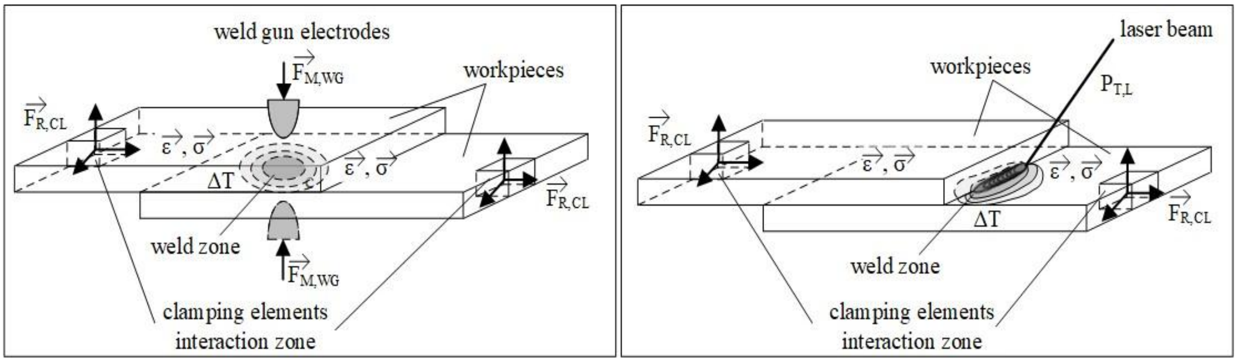

Fig.2.2 Welding tool impact and reaction forces at clamping elements during resistance spot welding (left) and laser beam welding (right)

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III. CONCLUSION

This paper has presented a new fixture design to optimization welding process and a methodology is used to increase number of quantity job produce in wedling. In study of various literature we oservered that if we make a special purpose machine to weld metal sheet in cylindrical form it would save time of handleing & welding. Now our task will to make some of designe concept for SPM and do some short of analysis for optimize them. SPM are those machine which are used for some special purposes and imphesis on accuracy and productivity.

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