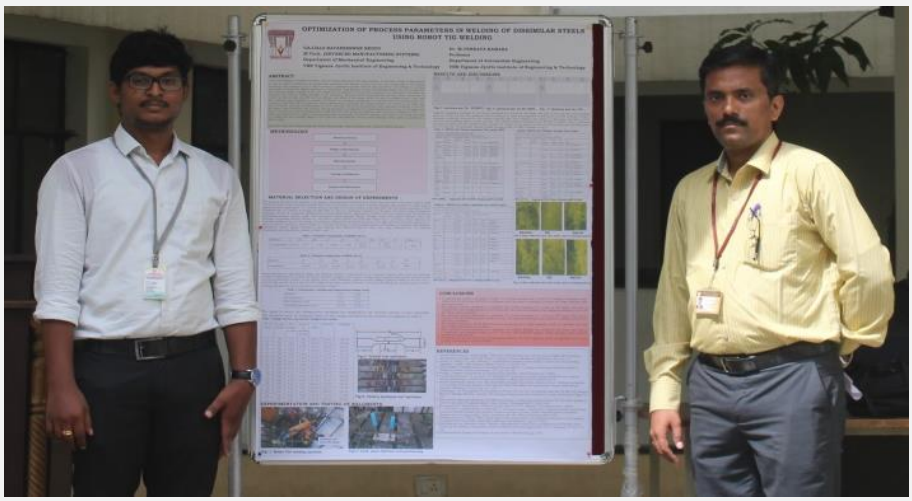
VNRVJIET

Department of Mechanical Engineering

M.Tech (AMS) Projects

Optimization of Process Parameters in Welding of Dissimilar Steels Using Robot TIG Welding

Robot TIG welding is a modern technique used for joining work pieces with high precision. In this work, Design of Experiments is used to conduct experiments by varying weld parameters like welding current, wire feed and traveling speed. The welding parameters play important role in effective joining of dissimilar stainless steel applications. The influence of welding parameters on Robot TIG Welded specimens is investigated using Response Surface Methodology (RSM). The Vickers hardness and Ultimate Tensile Strength of the each weldments are measured. The process parameters are optimized to maximize the hardness and Ultimate Tensile Strength of the weldments. Microstructural characterization through optical microscopy is observed in weld zone (WZ) and heat affected zone (HAZ). In the present study, the weld was autogenous and a post weld heat treatment conducted to evaluate its influence on hardness. It is observed that the hardness in weld zone (WZ) is high as compared to HAZ. The optimum process parameters to maximize the Vickers hardness are current at low level, wire feed is high level and travelling speed is high level. The hardness under optimum conditions is 231.079 HV. The optimum process parameters to maximize the ultimate strength are current at middle level, wire feed is middle level and travelling speed is high level. The predicted ultimate tensile strength under optimum conditions is 489.744 MPa.

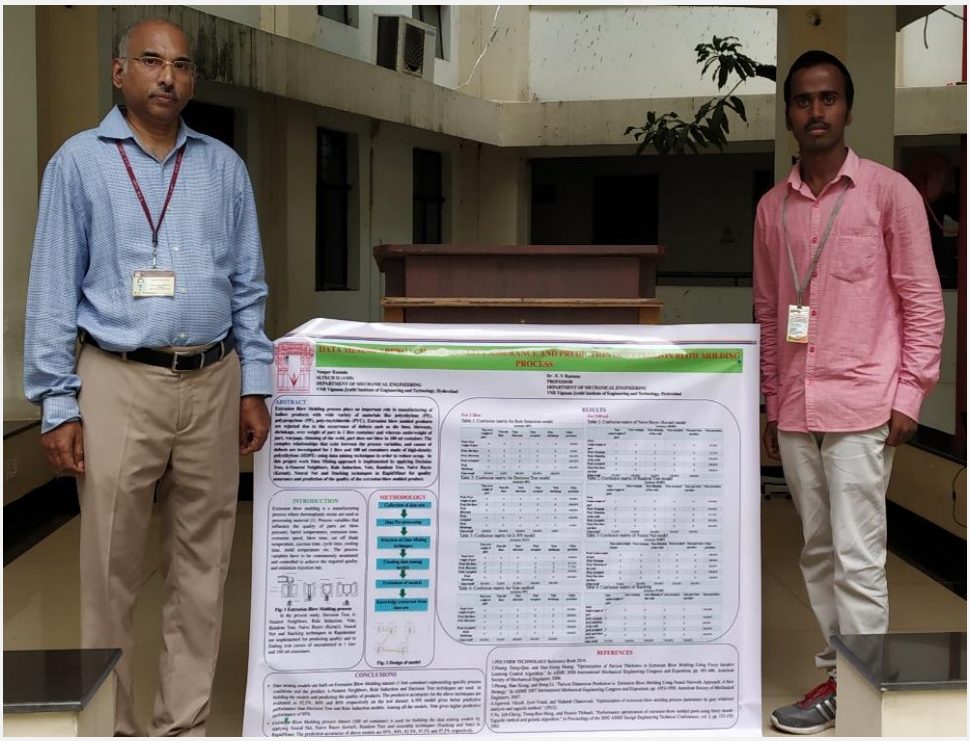


Effect of Tool Pin Profiles in Characterization of AA5052 Using Friction Stir Welding

Friction stir welding (FSW) is a low heat input solid state welding technology. It is often used for fabrication of aluminum alloys in transportation applications including railway, shipbuilding, bridge structures and automotive components. In these applications the material is frequently subject to load conditions and tensile failure is a critical issue. This work presents the characterization of AA5052 joined by using friction stir welding technique. Three tools are fabricated with three different tool pin profiles (square, pentagon and hexagon). Welds are fabricated by using these tools by considering three weld speeds (40 mm/min, 60 mm/min, 80 mm/min). Three tensile specimens were cut from each weld for tensile testing. Tensile results show that tensile strength is highest (211±4.89 MPa) at 60 mm/min by using hexagonal pin and tensile strength (182±19 MPa) is low at 80 mm/min by using square pin due to high heat produced during welding. Welds fabricated using hexagonal pin at 60 mm/min transverse speed showed the highest impact strength of 34.16±1.04 J. Hardness results were shown that in almost all welds nugget zone has more hardness than other zones due to dynamic recrystallization. Simulation results also shown that equivalent stresses developed during welding the plates depend upon the type of tool pin profiles.

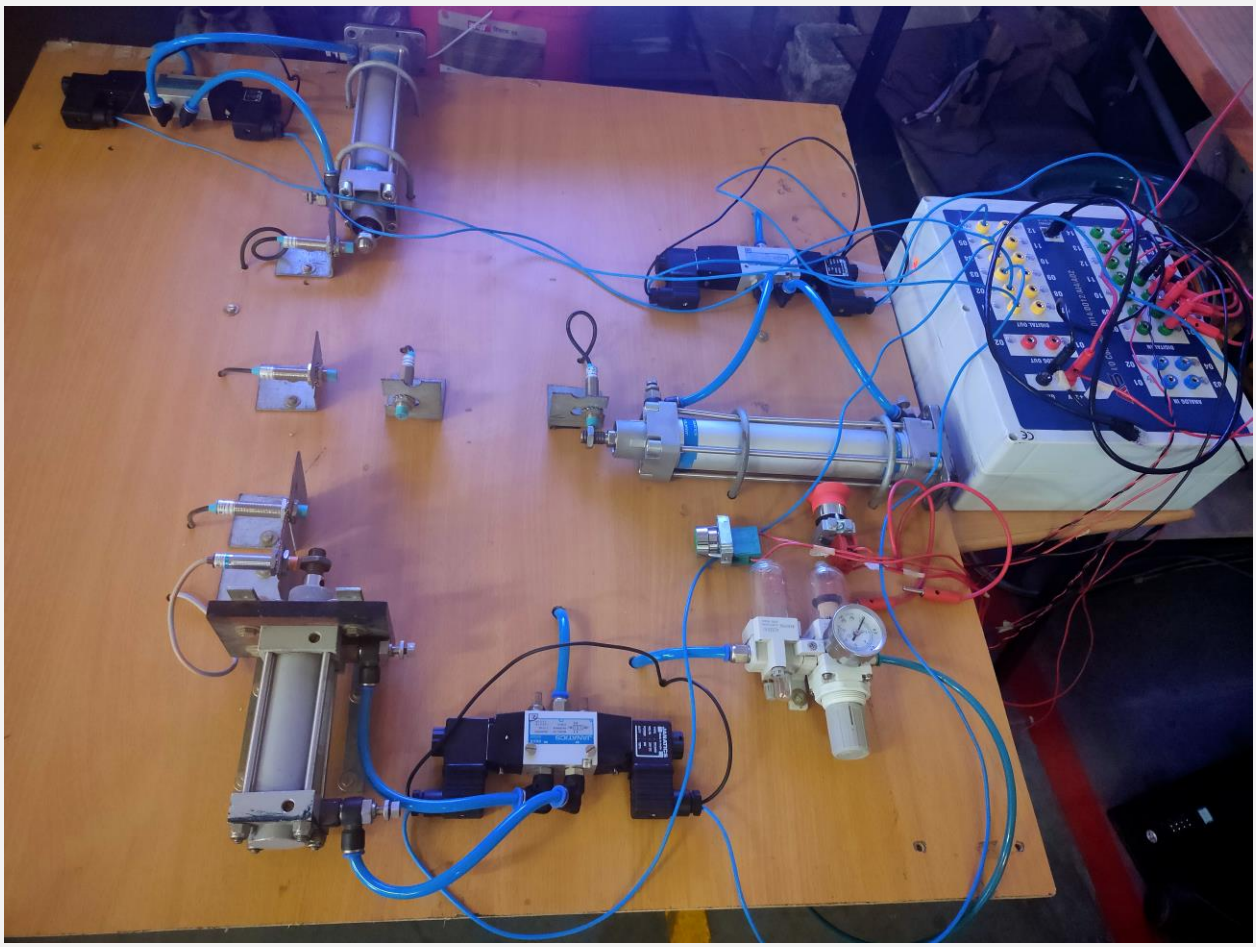
Data Mining Approach for Quality Assurance and Prediction of Extrusion Blow Molding Process

In Extrusion Blow Molding process, the manufacturing of hollow products are produced by using semi-molten tube (parison). During processing of the product, the defects arise are die lines, blowouts, shrinkage, over weight of part in 1 litre container and whereas underweight of part, warpage, thinning of the weld, part does not blow in 100 ml container. The deviations in process variables are responsible in causing the defects in products. The data mining techniques are applied in finding the relationship between process variables and causes of defects. In this project work Data Mining approach is implemented by applying Decision Tree, k-Nearest Neighbors, Rule Induction, Vote, Random Tree, Naive Bayes (Kernel), Neural Net and Stacking techniques in the RapidMiner. These techniques are implemented on Extrusion Blow Molding Process datasets collected during the manufacturing of 1 litre and 100 ml containers in building the data mining models for the assurance of quality and predictions of product quality.



Design and Simulation of Automated Pad Printing Machine using Automation Studio.

Indeed, the prospect of creating a realistic virtual model (3D model) and using this model in virtual simulations to test the system & functionality in potential real-world scenarios plays a key role in the advancement of digitalization. Pad printing is a technique that transfers a 2D image onto a 3D object. To print on complex products produced in the industries such as automotive, medical, electrical objects, sports equipment's, and toys, can be possible by the pad printing machine. PLC and pneumatic actuators as the main role in this project, where Pneumatic components are used for mechanical movements and PLC are used to operate the pneumatic components. Interfacing the mechatronic system with Automation studio (AS) and controlling the system using IO box which creates a link between the Automation studio and the mechatronic system.



Experimental Evaluation of Weld Characteristics of AA 2014-T6 Aluminum Alloy using FSW and GTAW Processes

The comparative study of welding characteristics of aluminium alloy AA2014- T6 welds, in conjunction with the use of two techniques, specifically Friction Stir Welding (FSW) and Gas Tungsten Arc Welding (GTAW), changed into finished inside the deliver-out research work. Three distinct geometrical tool pin profiles together with triangular, square, pentagon with system variables which include tool rotational speed of 1400rpm, traverse speed of 86mm/min and tool tilt perspective 3º have been used for FSW manner. The GTAW cycle turned into executed the use of Constant Current Welding (CCW) and Pulse Current Welding (PCW) at frequencies of 2Hz and 4Hz respectively. This studies contribution to the take a look at of the Ultimate Tensile Strength (UTS), 0.2 % Yield Strength (YS) and % of Elongation (% E) of FSW and GTAW AA2014-T6 welds. An strive turned into additionally made on metallurgical residences of AA2014-T6 weldments. Weldments was discovered from the microscope to study the grain length and grain shape at Nugget Zone (NZ), Thermo- Mechanical Affected Zone (TMAZ) and Heat Affected Zone (HAZ).

Damage Characterization of Sandwich Composites Subjected to Impact Loading

Advanced composite materials are usually optimized to achieve balance of properties for given range of applications. In recent times, researchers had worked on the sandwich composites by using different foam and metal honeycomb as a core material. In the current project, honeycomb core is prepared by using 3D printed technology. In this case of sandwich composites, cross-linked polyethylene foam and 3D-printed polylactic acid honeycomb as core and GFRP is used as face sheet. The comparison is made between polyethylene foam and 3D printed honeycomb core sandwich composite in the aspect of toughness, strength, and modulus. The present study is to characterize the damages in the sandwich structure for the amount of energy absorbed by the structures such as delamination, indentation, crushing of foams, and debonding of face sheets and core material subjected to free fall impact. The contact force versus time, contact force versus deflection of plates with respect to impact energy levels of 9.3, 16.5, and 25.7 J and impact energy versus time are determined. The current research helps in determination of core materials effecting/absorbing the damage and behaviour of sandwich materials subjected to impact loads.

Optimization of Process Parameters in Dry Turning of Hardened 20mncr5 Alloy Steel Using Machine Learning

In recent times dry machining has been used as an alternative method in place of the conventional machining process as the usage of cutting fluid has many side effects. In this experiment, 20MnCr5 has been selected as workpiece material to perform a dry turning operation after it had been case-hardened up to 51 HRc. Manufacturing of piston bolts, spindles, camshafts, gears, and shafts are the main applications of 20MnCr5. For the experimentation, a TH1000 insert which is a PVD-coated grade is be utilized as the workpiece was hardened. In Minitab software, the Taguchi technique is utilized for the design of the experiments and to find the optimum conditions for machining. ANOVA is performed to interpret results and to determine the significance of factors. Cutting speed, feed rate and depth of cut were the input parameters considered for the experimentation at three levels. Surface roughness, tool wear, material removal rate and power consumption were the output responses that were checked after the machining process. Both mono-objective optimization and multi-objective optimization were performed. Mono-objective optimization was done to find the optimum condition for each individual output response and for multi-objective optimization, grey relational analysis was used where the optimal condition is found for all output responses combined. Optimization was done to minimize the surface roughness, tool wear and power consumption, and to maximize the material removal rate. In multi-objective optimization, the optimal condition was achieved at 0.1mm/rev feed, 80 m/min cutting speed and 0.5 depth of cut. Feed rate was the most significant factor followed by cutting speed.

Enhancement of Mechanical Properties of Matrix by Functionalized Multi-Wall Carbon Nanotubes(MWCNT) in Composite Material

CFRP (Carbon-fiber-reinforced polymers) are Carbon composite fiber-reinforced polymers that are incredibly strong and light. Although CFRPs can be costly to manufacture, they are frequently employed in applications that demand stiffness and high strength-to-weight ratio (rigidity).The properties of hybrid composites are influenced by various factors such as the type of reinforcement fibers, Nano fillers, matrix materials, and the methods used in their production. When it comes to enhancing the structural integrity of composites, Functionalized Multi-wall carbon nanotubes (MWCNTs) and reinforced epoxy composites with carbon fiber are particularly effective fillers. In this study, the focus was on incorporating Functionalized MWCNTs into epoxy resin matrices with the objective is to enhance the durability of resins and the ability of fiber-reinforced polymers (FRPs) to withstand tension. To evaluate the impact of Functionalized MWCNTs on the mechanical and tensile properties of the epoxy, a quantity of 0.25 grams of these nanotubes was added to the epoxy resin. The study aimed to determine how this addition affected the overall performance of the epoxy, particularly in terms of its strength and ability to withstand stretching forces. The properties of hybrid composites, such as their strength and durability, are affected by various factors including the type of reinforcement fibers, Nano fillers, matrix materials, and the methods used in their production. When it comes to strengthening purposes, functionalized Multi-wall carbon nanotubes (MWCNTs) and other materials like reinforced epoxy composites/carbon fiber are particularly effective as fillers. By incorporating functionalized MWCNTs into resin matrices, researchers aim to improve the toughness of resins and increase the tensile strength of fiber-reinforced polymers (FRPs). In this work, 0.25 grams of functionalized MWCNTs were introduced to epoxy to investigate their influence on mechanical and tensile qualities.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