REST Journal on Advances in Mechanical Engineering

Vol: 2(1), March 2023

REST Publisher; ISSN: 2583-4800

Website: http://restpublisher.com/journals/jame/

DOI: https://doi.org/10.46632/jame/2/1/5

Optimization of Welding Process Parameters Using the VIKOR MCDM Method

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Abstract. *Optimization of welding process parameters These welding parameters are welding current, welding voltage, gas flow rate, wire feed rate, etc. They affect welding strength, weld pool geometry of steel material during welding. By using the DOE method, the parameters can be optimized and have the best combination of parameters for the target quality. The VIKOR (VIšekriterijumsko Kompromisno Rangiranje) Optimal replacement Select method is used Biomass product, Catalyst, Solvent, Temperature/ K. in Evaluation. Alternatives Wood, Bio-oil, Lignin, Glucose, Saccharine is the Best and Worst Value. Saccharides is got the first rank whereas is the Glucose is having the Lowest rank.*

Keywords: *Wood, Bio-oil, Ligni, Glucose, Saccharides, Biomass product, Catalyst, Solvent, Temperature/ K, SPSS Method.*

1. INTRODUCTION

Common affect the required output welding Process parameters process Welding speed, arc voltage, welding current etc length of arc, angle, handling, speed. A variety of selected Weld for welding processes Process parameters vary. These welding parameters are welding current, welding voltage, gas flow rate, wire feed rate, welding strength; steel during material Weld pool geometry Affects method, parameters Use it for optimization and target quality May have a better mix. The top welding parameters to consider during arc welding are: amperage, voltage and wire feed speed. In most welding processes, if these welding parameters are not set correctly, all of them can affect the finished weld, P number, F number, a number PWHT, thickness (outside the specified range) is an essential variable in the welding process specification. the VIKOR approach is complex. Developed to optimize more than one standards system. This is a compromise ranking list by preliminary (given) weights Also determines the compromise response obtained. This approach, ranking and specializes in determining from it hard and fast in the presence of contradiction Alternatives standards.

2. OPTIMIZATION OF WELDING PROCESS PARAMETERS

Welding process parameters Necessary of penetration to reach depth and HAZ width. According to the design matrix suggested by RSM Bead on plate welding tests were carried out. Numerical and graphical optimization using RSM Required depth of penetration and desired HAZ width Gets the attitude. of the GA-based model Process using generated data for development with parameters Weld bead shape parameters First multiple regression models for correlation were created. Then regression models are optimized In GA to determine the process parameters were used. In a GA-based model, the elec the process is different and their performance evaluation is done. The models suggested several solutions and Through tests of identified solutions Verified. Performances of models later 9Cr-1Mo A-TIG welding process for steel parameters were compared to optimize [23]. Welding process parameters are more available Beneficial welding pool geometry Generally, preferred welding process parameters decided empirically or from a mentor. However, selected Welding technique parameters specific welding the gold standard for gadgets and the environment or superior weld pool geometry It does not guarantee that it can be created. Ultimate weld pool geometry is mentioned [25]. The pulsed GTAW process is lean and mean for bonding with thick materials Appropriately, A. G. Stainless steel sheets and weld metal Metallurgical manipulation of important compositions Mechanized welding, welding process of parameters and welding with advanced usage the choice of process is to be more specific Need, accurate fine weld bead parameters Minimum charge and excess again Make sure that repeats are done. [27]. They have a look at simplest analyzed that the purpose of

the failure became as a result of the extraction etching quarter with excessive attention of phosphorus masking the pipeline, and did not analyze the purpose of its formation within the welding process and welding parameters [29]. Welding procedure parameters are essential to acquire best weld bead geometry Usually, defining the for newly welded items Weld input parameters are specific Time consuming with specifications take a look at regarding blunders correction attempt and skill of the welding engineer or welding system operator in choosing the precise welding input parameters [34]. Close friction stirs welding method parameters Traction power and very efficient by evaluating the position was optimal the systems become observed. The most fulfilling degrees [35]. The surface finish parameters of welding and welding rail should be modified. Railway evaluation An FBW joint of U75V type steel Fatigue fracture technique in according to repeated fatigue failure. FBW parameters are mainly welded Fatigue performance of rail they found that affect Investigated the causes of Welded repaired failure of rails and Residual in crack propagation Rolling pressures [28]. The intention of the existing research became to improve best homes. Welds are made the usage of the greatest circumstance obtained and those welds are subjected to bloodless flashing procedure. Roll blasting is a useful manner in which the weld is for two steel rolls There is more in the middle. Glowing During operation, internal pressures prompted for the duration of Welding relief and grain are destroyed. Hence, the machining of welds Properties are improved [32]. Increases welding parameters. Exploring the A special feature of orthogonal arrays Defined using format with numerical tests Full parameter space to solve this problem for improving welding parameters Simple and strong Subtly detected [26]. The residences of welded joints are suffering from a big quantity welding parameter. Weld to predict the goodness of welds Modeling of the beat pattern is important. Welding The bead parameters of joints (bead geometry parameters also known as) to model the predictive welding method in practice, Tungsten Inert Gas (TIG) welding Modeling bell parameters in practice and Upgrades are prizes Attempts have been made in the work [22]. Welding method parameters and bead performance, welding-bead laser welding Reaction to study the influence of parameters Site technique (RSM) is used. Artificial Neural Networks (ANN) have been used by many researchers for various material geometries in different joint structures while optimizing [24]. Relatively simple principle and cost effective Such as automobile bodies due to facilities Assembly proceedings. Determines welding quality Factors, however, resistance spot welding Each other even in an easy-to-use practice Influences heavily, it is satisfactory welding Getting quality is difficult. Trial and error desired weld quality using the method it is inefficient to set the conditions necessary to obtain is the task. So, using welding process model, by exposing the welding to produce the desired weld quality It is important to determine the optimal conditions quality through a limited number of tests [30]. The direction of welding is to the rolling course Changed normally. Joints Unmarried pass welding system to create was used. Non-consumable Threaded cylindrical pin profile product of excessive carbon metallic become used to put together Joints. Domestically Designed and developed gadget [31]. Friction welding is a solid accession process This is in recent times Widely used blessings which include low warmness input, high productiveness, Ease of manufacture and Environment friendly Available items hard to weld by friction welding through fusion welding techniques Can weld effectively. Tensile friction welded by experiential bond that anticipates power an attempt was made to increase Great effect on joint energy. The response floor method was used to optimize friction welding process parameters Joints get more tensile strength. 90 MPa friction Pressure, 90 MPa forging strain, welding 543 for fabricated joints under the circumstances MPa ultimate tensile strength was obtained 6 2nd friction time and six second forging time, [33].

Wood:

Wood is the first-rate and of timber and other woody plants Determined within stems and roots Fibrous structural tissue. It is an organic material - cellulose A herbal mixture of fibers, which in short in a strong and shrinkage-resistant lignin matrix is embedded. In addition, famous merchandise which includes timber, furniture and plywood, wood is a uncooked material for wood-based panels, pulp and paper, and many chemical merchandise. Finally, wooden continues to be a primary gasoline in maximum components of the sector.

Bio-oil:

Bio-Oil is a cosmetic oil that reduces the appearance of acne scars. It smoothes out wrinkles and reduces hyper pigmentation on the face. Bio-Oil is the name of the oil and Name of the product manufacturer. in oil Calendula, lavender, rosemary and chamomile Contains a long ingredient list.

Ligni:

Lignin is an important Organic A is a polymer is the cell of cells Walls abound This is water Transportation, mechanical support and Many such as resistance to various stresses Has biological activity.

Glucose:

Blood sugar, or glucose, in your blood The main sugar found is This is what you eat Food comes from food and is your body's main source of energy through Your blood is all of your body It also provides cells with glucose for energy.

Saccharides:

A saccharide is the unit structure of a carbohydrate. In biochemistry, Saccharides are carbohydrates or are sugars, which are diverse biochem Fuel the processes Act as a major source of energy for carbohydrates The chemical formula is Cn(H2O)n and this formula indicates whether the saccharide is simple or complex.

Biomass product:

Biomass is renewable organic substances, consisting of bushes, flowers, grasses, vegetables, algae, food wastes, animal manures, and other natural wastes. Each kind of biomass has a one of a kind composition, including sugar content material, calorific cost, moisture content, and ash content.

Catalyst:
A man or woman or issue that triggers an event or change: His imprisonment via the authorities helped flip social unrest into revolution. A person whose speech, enthusiasm, or electricity makes others more friendly, enthusiastic, or active.
Solvent:
A solvent is a chemical substance that dissolves every other chemical substance to shape a solution of the identical composition. Solvent is the component in the solution which is present in the biggest amount and determines the physicochemical form of the substance as stable, liquid or gasoline.
Temperature/ K:
Kelvin (abbreviated K), usually a diploma Kelvin (Fig., o K) is called It is thermodynamic temperature is the standard international (SI) unit. A Kelvin is officially 1/273 is described as Sixteen (three.6609 x 10 -three) Three of natural water Thermodynamics of factor Temperature (H 2 O).

3. VIKOR

The VIKOR approach is added as an adaptive approach implemented inside the MCDM problem and is evolved Inapplicable (exclusive units) and A unique choice of contradictions many to solve the problem of doing asan attribute selection technique standard. Help selection makers arrive at a final answer. A Multi-criterion for compromise ranking Metric lb-for metric is used. aggregation feature within the compromise programming method [15]. The VIKOR method turned into advanced for multivariate Preliminary (Given) Preference of compromise solution obtained with weights Determines the load stability periods for equilibrium. In the presence of this approach contradiction Evaluation from a fixed set of alternatives and focuses on selection standards [16].The VIKOR technique changed Multiple criteria in complex structures Built to improve and great reputation received Contrasted and exceptional unit Ranking with grades and alternatives It specializes in selection. VIKOR in approach, it's close to a first-rate alternative Compromise by assessing charter Rankings are being completed, too a compromise is an agreement. way of mutual options [17]. VIKOR is used to assess medical institution service exceptional due to the fact this technique represents a compromise selection in an indistinct, ambiguous and uncertain environment. For this purpose, the principle cause and contribution of this look at is to advocate a collection fuzzy-based totally compromise VIKOR method with parameters by way of fantastic triangular numbers (TFNs) on the way to be considered later, and the set principle and VIKOR approach [18]Might be added within the next segment. VIKOR Index is well matched. Taguchi's SN rate is simultaneously an excellent characteristic Considers recommendation and variation and VIKOR Index simultaneous use and regret Measures to improve multi-response method [19]. The VIKOR technique is brought as an identical technique applied within the MCDM hassle and developed as a multi-standards selection-making technique [20]. The VIKOR method makes decisions to provide method by researchers Finished hard issues with extra correct solutions. This involves using simplest VIKOR, the nation of the artwork of VIKOR specialty in this paper and as we shall see Uniquely, mathematics. you Different from VIKOR It can be found in the documentation The proposal can be evaluated approach [21]. The VIKOR technique is based on integrative fuzzy qualification Qe, which for a first-class solution represents the alternate distance. Functions and routines in developing a set of VIKOR rules Rank numbers are usedA numerical example illustrates using the VIKOR technique in water resources planning, which targets at numerical justification [22]. VIKOR with incomplete statistics for analysis of land use techniques to reduce economic and social expenses with capability natural dangers. The bad defines the solution with the furthest distance from the appropriate answer and the answer with the short of a suitable solution Far, but it does no longer take into account of these distances' Relative importance [23]. The VIKOR technique includes defining positive and negative perfect points within the answer area. It makes a speciality of Possible in the presence of contradiction Limited of options Ranking from set and choosing and incompatible (attributes with specific units) standards. While the VIKOR method solves demonstration examples. It is also attempted to pick out the fine appearing VIKOR approach the usage of Spearman's rank correlation coefficient values [24].

ANALYSIS AND DISCUSSION

TABLE 1. Optimization of welding process parameters Determination of best and worst value

	Biomass product	**Catalyst**	**Solvent**	**Temperature/ K**
Wood	10.504	17.083	45.062	25.036
Bio-oil	25.421	13.56	17.025	23.632
Lignin	23.451	32.123	45.362	41.035
Glucose	15.023	36.025	42.036	15.265
Saccharides	25.63	15.202	12.63	36.025
Best	**10.504**	**36.025**	**45.362**	**15.265**
Worst	**25.63**	**13.56**	**12.63**	**41.035**

Table 1 shows the Optimization of welding process parameters for VIKOR method. Biomass product, Catalyst, Solvent, Temperature/ K. in Evaluation. Alternatives Wood, Bio-oil, Lignin, Glucose, Saccharine is the Best and Worst Value.

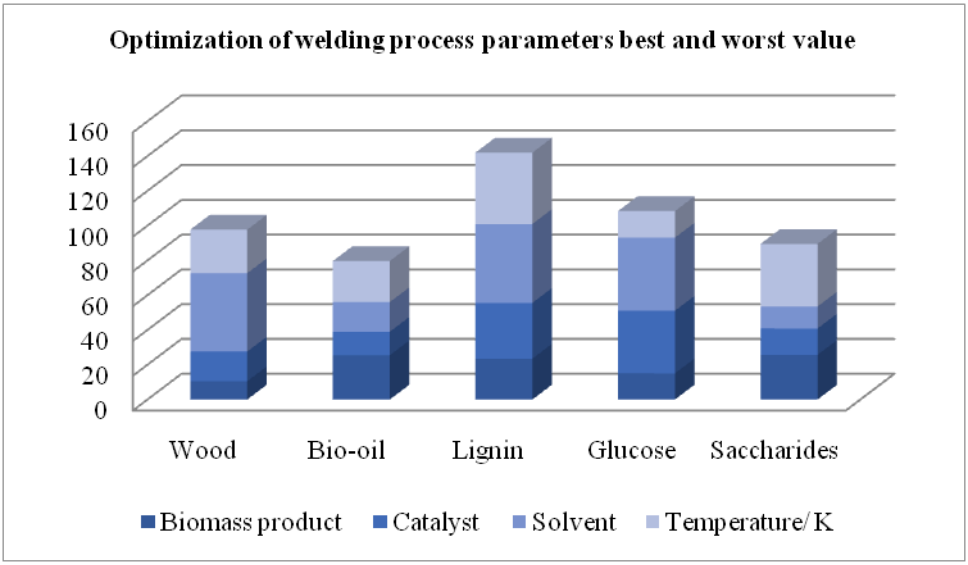

FIGURE 1. Determination of best and worst value of Optimization of welding process parameters

Figure 1 shows the Optimization of welding process parameters for VIKOR method Biomass product, Catalyst, Solvent, Temperature/ K. in Evaluation. Alternatives Wood, Bio-oil, Lignin, Glucose, Saccharides it is seen that Wood materials market is showing the Best value for Biomass product and Saccharides is showing the Worst value. Glucose is showing the Best value for Catalyst and Bio-oil is showing the Worst value. Lignin difficulties is showing the Best value for Solvent and Saccharides is showing the Worst value. Glucose and processes is showing the Best value for Temperature/ K and Lignin is showing the Worst value

TABLE 2. CalculationSj and Rj

				Sj	**Rj**
0	0.210795	0.002291	0.09479	0.307876	0.210795
0.246546	0.25	0.216432	0.08117	0.794148	0.25
0.213986	0.043423	0	0.25	0.507409	0.25
0.074689	0	0.025403	0	0.100093	0.074689
0.25	0.231727	0.25	0.201397	0.933124	0.25

Table 2 shows the calculation Sj and Rjis the sum of Normalization of the tabulation 1 which is calculated from the Determination of best and worst value.

TABLE 3. Final Result of Calculation Qj

	Sj	Rj	Qj	Rank
Wood	0.613461	0.307876	0.306027	4
Bio-oil	1.125318	0.794148	0.809452	2
Lignin	1.007409	0.507409	0.588613	3
Glucose	0.174782	0.100093	0	5
Saccharides	1.384521	0.933124	1	1

Table 3 shows the Final Result of Calculation Qj calculated from the sum of the calculation from the Sj and Rj from the Qj value the rank is taken.

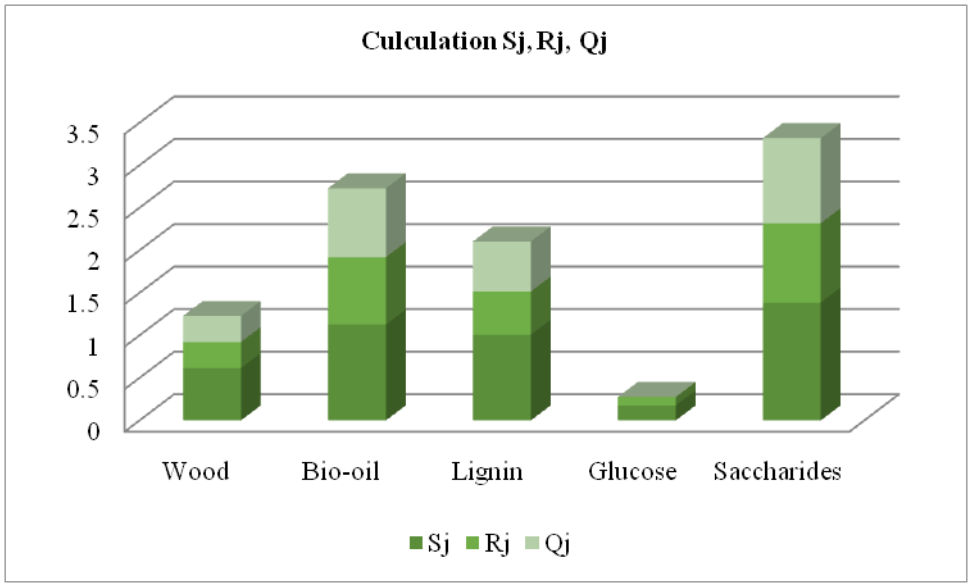

FIGURE 2. Calculation Sj, Rj and Qj

Figure 2 Shows the Calculation Sj, Rj and Qj Optimization of welding process parameters using VIKOR method. Qj for Saccharides is showing the highest value and Glucose is showing the lowest value.

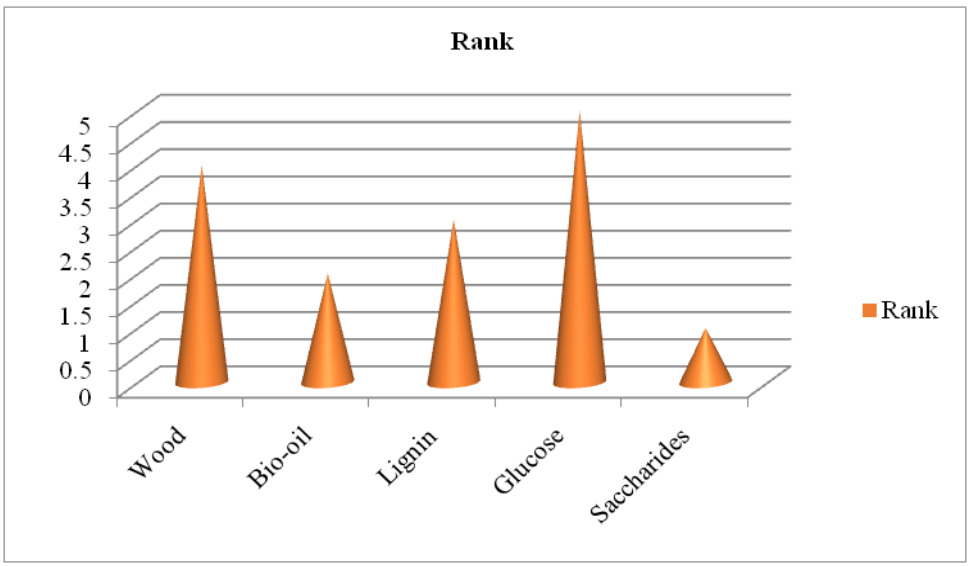

FIGURE 3. Shown the Rank

Figure 3 Shows the Rank of Optimization of welding process parameters for using the analysis of VIKOR Method. Saccharides is got the first rank whereas is the Glucose is having the Lowest rank.

4. CONCLUSION

Welding process parameters to achieve required depth of penetration and HAZ width. Bead on plate welding tests were carried out according to the design matrix recommended by RSM. Numerical and graphical optimization is performed using RSM to obtain the desired depth of penetration and HAZ width as desired approach. For the development of the GA-based model, the first multiple regression models were developed to correlate the weld bead shape parameters with the process parameters using the generated data. Then the regression models were used in GA to determine the optimal process parameters. In the GA based model, the selection process is different and their performance is evaluated. The VIKOR approach is added as an adaptive approach implemented inside the MCDM problem and is evolved Inapplicable (exclusive units) and A unique choice of contradictions many to solve the problem of doing as an attribute selection technique

standard. Help selection makers arrive at a final answer. A Multi-criterion for compromise ranking Metric lb-for metric is used. aggregation feature within the compromise programming method. The VIKOR method turned into advanced for multivariate Preliminary (Given) Preference of compromise solution obtained with weights Determines the load stability periods for equilibrium. In the presence of this approach contradiction Evaluation from a fixed set of alternatives and focuses on selection standards. The VIKOR (VIšekriterijumsko Kompromisno Rangiranje) Optimal replacement Select method is used Biomass product, Catalyst, Solvent, Temperature/ K. in Evaluation. Alternatives Wood, Bio-oil, Lignin, Glucose, Saccharine is the Best and Worst Value. Saccharides is got the first rank whereas is the Glucose is having the Lowest rank.

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