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Different Welding Processes Using Statistical and Numerical Approaches Using the Fuzzy TOPSIS Method

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Abstract

Welding is for two or more parts heat; pressure or Linking is a fabrication process cooling of parts. Welding usually involves metals and Used in thermoplastics, but also in wood can be used. A finished welded joint May be referred to as good material. Welding such as metals, thermoplastics, and/or wood Applying heat or pressure to materials It is a process of joining them together. Cool those down Allow enable the connection. Different Processes and techniques unique to materials required there are some people items that are considered unusable. MIG welding uses an electrode wire and shield gas fed continuously through A lamp held in the hand. A consumable for TIG welding is tungsten uses an electrode, which is a supply line, and Shield through a separate, hand-held filler wire manually injected into the weld pool with gas. Research significance: Welding is two or more parts by heat, pressure, or both together Linking is a fabrication process. Welding is usually in metals and thermoplastics used, but can also be used on wood. The finished welded joint may be referred to as a weld meant. Gas pressure welding joins two base materials in under pressure by heating them with gas contact. Resistance spot welding two Combine the basic ingredients together heating up with heat generated by electrical resistance by conducting current. The basic purpose of welding is within a solid joint combining two elements. Welders in general Work with metal or thermoplastic and durable filler material to hold together are using Skyscrapers in our world, many modern ones like cars, ships, and planes Welding is used to make structures. Mythology: Alternative: Factorial designs, ANNs, GA, and RSM. Evaluation Option: Computational time, Experimental domain, Model developing, Availability in software, Optimization Accuracy level. Result: from the result it is seen that Model developing and is got the first rank whereas is the Availability in software got is having the lowest rank. Conclusion: The value of the dataset for Welding Process in Fuzzy TOPSIS method shows that it results in Model developing and top ranking.

Keywords: Factorial designs, Computational time, Experimental domain, Model developing.

Introduction

The most important aspect of FW is that different A wide range of alloys of metals can ignite. For this characteristic, the FW process is all other welding's Needless to say, processes are also surpassed. The pairing process is automatic is, highly reproducible and uses processing techniques that combine conditions that have been found essential for materials production in recent years. [2] A distinctive A feature of the friction-wave welding process Aspect is near the foot rotating tool Transport heat by plastic flow of molecules facilitated. Properties of Heat and Mass Transferring Matter Mass transfer and tool rotation and welding Depends on the welding variables speed and its geometry. In FSW, the metal and by excreting large quantities Assimilation also takes place through forgery rate. [3] The current one The tool is limited to geometry because Effect of tool geometry on the welding process The investigation is very much due to the complexity of the pin geometry It will be difficult. Test for this type of welds Results Predicted temperatures from the numerical model are used to check. [4] Complex Welding process parameters and weld pool Relationships between features were considered. Input Process parameters: welding speed, wire feed speed, cleaning percentage, arc spacing, and welding Current, Output Features: Front Height, Front Width, Back height, and back width. [5] Observe the changes that occur as a result of heating the material. Three zones corresponding to different heat transfer rates can be distinguished during the welding process. The dividing line between different zones can be clearly determined. The zone at the top of the weld corresponds to an additional post-weld cosmetic pass, [7] to fully determine the mechanical response Due to welding heat cycle, semi-constant temperature determined by analysis; A full three-dimensional incremental plasticity analysis is Required, at least, in each period to recalculate stiffness coefficients. Run the computer Times can be huge, so cost is also an obstacle Maybe. Initially, normal to the direction of the weld Computational Technique for Analyzing Sections were created. [8] Hence, conventional modeling and control methods Designing an effective control program through difficult A model to control the welding process- Free Adaptive Control Algorithm generated, the observed input for which is- Only output data is required and Modeling for controlled welding process Don't want. [9] The heat generated during the welding process, the tool for the power input introduced into the weld by the min minus some losses due to structural effects. Peripheral velocity translation

of shoulder and probe is greater than speed. FSW primarily involves viscous dissipation in the tool material uses, which is more of a tool/workspace interface driven by shear stresses. [10] To relieve the residual stress caused by this, welding The process causes the structure to warp and disintegrate. There are many methods of decomposition, but very common, especially thin welded In structures, bending deformation is the parent Stress is caused by stress on the material. Bucking Due to which distortion is becoming more common [11] Welding voltage U, wire feed speed, welding, and the distance between the gun tip The key is to protect the gas mixture by exploring For optimization of welding process parameters and substrate, and their effects on bead geometry and weld. [12] The The first group of analyzes relates to welding speed: Keeping the same mesh size, different welding We have performed a group of simulations with velocities. You can "Numerical Welding Process Simulation/Free" We report on our efforts. Visit the website and be insightful See Appendix 1-4 of this article for animations Download the. [14] According to the most encountered conditions and very Means by simple tri-pedagogical experiments Coherence of flow is sufficiently Not specified, hence the welding process itself is Used in most analyzes in the literature, However, its complexity makes it possible to use simplified numerical models led to and attitudes. The latest development in highly accurate 3D simulation software FSW allows modeling the entire complexity of the process. [15] A moving heat source is a typical transient that is activated as a formula, where the heat source is Moving with the area over time. To model the heat source, the Proposed three-dimensional dual elliptic geometry is studied, double elliptic geometry characteristic Shallow penetration arc welding processes and Deep penetration laser and electron beam To model both. processes [16] After completing Welding processes, to measure the depth of penetration A closed circuit cooled with boron oil Simple using a saw perpendicular to the direction of welding was cut. Cut surfaces 600, 800, and Sand with 1200 grit sandpaper etched and etched with 10% HNO3 solution. [17]

Methods And Materials

Beijing Metro using Fuzzy TOPSIS method is a case study Assessment service quality of an organization proposed. when assessment process, Beijing Metro Operating Co., Ltd. 8011Surveys are from 16 operating metro lines were collected. Not very satisfactory for passengers The three are the exchange, the experience of traveling in the vehicle and the purchase or recharge of tickets Factors are evaluated. It should be greatly improved in metro travel and future construction city administration. [1] Trapezoidal hesitation fuzzy set, trapezoidal hesitation intuitionist fuzzy set, Interval-valued trapezoidal reluctance is intuitive Fuzzy number, trapezoidal Fuzzy number, trapezoidal Interval Hesitation Intuitive Fuzzy Topsis method, interval-valued trapezoidal Reluctance is an intuitive fuzzy topsis method and Comment cubzyicsoidal fuzyidation Introducing. [2] Fuzzy TOPSIS on bid/no-bid decisions Factors in the framework to demonstrate the approach are a example In practice, some factors May not be used or Product, industry and other factors depending on market characteristics may be included [3] He proposed that hybrid methods began With a survey for data collection. of the data obtained basically to prioritize project risks A relative importance index was used. Construction projects are then Fuzzy AHP and Fuzzy TOPSIS methods are categorized by For Fuzzy Bussy Cup (Bahp). Linguistic variable of overall construction projects Used to create positive weights. [4] Demonstrated Fuzzy DEMATEL, Fuzzy VIKOR, Fuzzy AHP and Fuzzy TOPSIS are problem-solving facility layouts are for approaches. Fuzzy AHP and Fuzzy TOPSIS A comparison between methods has been carried out [5]. The criterion Environment, economy, society, and energy organization and transport Different alternative and criterion weights by five expert groups in the field of organization Performance was determined. Finally, EVCS site alternatives Fuzzy Topsys method were ranked using EVCS located in the Transition District in Beijing Site A2, which has the highest ranking scores and selected as the optimal site result shows that [6] Oil and gas protection Based on criteria only Fuzzy TOPSIS for selecting suppliers field This is the first study to use Qualified Contractors Selection of oil and gas companies It is an important step in the success of programs and activities. A strong Selection process, appropriate criteria Considering that, gives it more credibility selection. [7] proposed a Fuzzy TOPSIS method interval of valued fuzzy sets basically. They modified the information of the example presented by Chen for the purpose of debugging with their method and used their method to solve the modified example.[8] In a real word situation, Due to incomplete or unobtainable information Human judgments are often involved, including preferences Be vague and his/her choice Exact number cannot be estimated from data, data are general Fuzzy TOPSIS as it is fuzzy/precise We try to extend to the data. [9] Since Fuzzy logic is an ideal to support MADM methods , which is combined with the TOPSIS method is used. Fuzzy Tapsis two methods together called methods. Fuzzy topsis is classical is an extension of the Topsys method required Alternate/criterion evaluation values language specific.[10] An ambiguous positive is best for determining the order of alternatives Solution (FPIS) and ambiguous negative ideal Solution (FNIS). By calculating the distance Proximity coefficient is defined. Fuzzy TOPSIS method of our work Based on the results, study which do it best primary crusher for mining? shows. [11] Fuzzy TOPSIS enables AHP-fuzzy AHP to come to a decision in a short time, eliminating many procedures that need to be done only in the solution. Full AHP-Fuzzy AHP solution, criteria and If the number of alternatives is sufficiently small Only, pair wise done by assessor The number of comparisons should be reasonable. limit.[12] Use the AHP method calculates the Scale weights and alternative applications TOPSIS method to determine ranking. Using the method to assess the performance of organizations Wang different planes TOPSIS. TOPSIS and Fuzzy TOPSIS methods in different applications and so on In solving attribute decision problems are used. Are commonly used. [13] Since Criteria are AHP Fuzzy for Fuzzy and Uncertain Weight Estimation TOPSIS method is used. Five types the spillways are alternatively, nine criteria were selected. To compound the problem, the criteria are trigonometrically ambiguous are expressed as numbers. [14] Using a neutral a project portfolio or similar Parts of the project method for calculating the overall complexity score, Obscure topics presented here include, when dealing with problems driven by project complexity Easier discussions and more consensus allows [15]

Analysis and dissection

TABLE 1. Welding Process in Fuzzy TOPSIS method on the data set.

	DATA SET			
	Factorial designs	ANNs	GA	RSM
Computational time	68.08	569.53	39.15	74.05
Experimental domain	77.12	492.97	43.69	56.30
Model developing	89.08	642.58	19.18	37.10
Availability in software	60.17	278.28	64.60	58.59
Optimization Accuracy level	70.33	606.41	47.96	85.89

Factorial designs it is seen that Model developing is showing the highest value for Pure Availability in software is showing the lowest value. ANNs it is seen that Model developing is showing the highest value for Availability in software is showing the lowest value. GA it is seen that Availability in software is showing the highest value for Model developing is showing the lowest value. RSM it is seen that Optimization Accuracy level is showing the highest value for Model developing is showing the lowest value. Table 1 shows the Poly (lactic acid) of the Alternative: Factorial designs, ANNs, GA, and RSM. Evaluation Option: Computational time, Experimental domain, Model developing, Availability in software, Optimization Accuracy level.

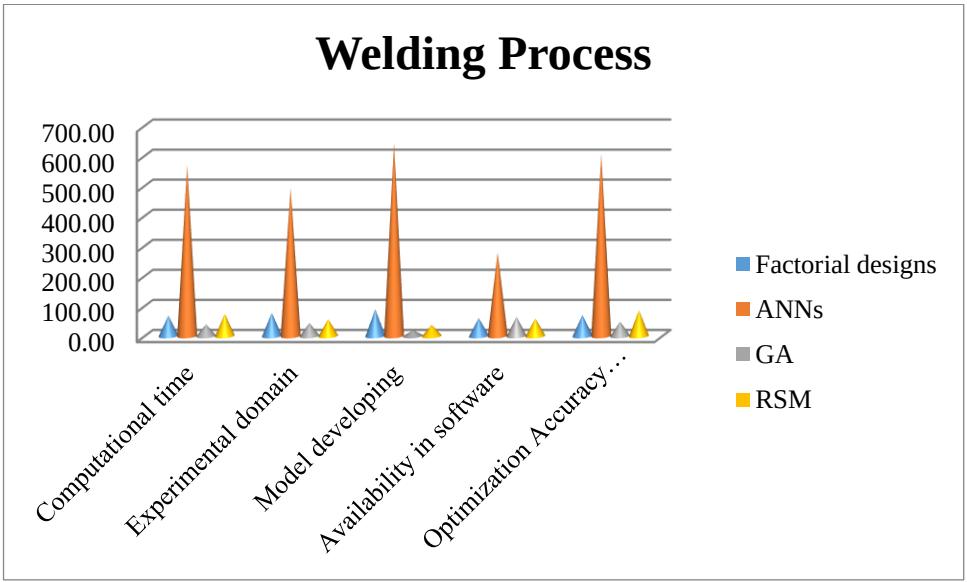

FIGURE 1. Welding Process

Alternative: Factorial designs, ANNs, GA, and RSM. Evaluation Option: Computational time, Experimental domain, Model developing, Availability in software, Optimization Accuracy level.

TABLE 2. Squire Rote of matrix

4634.8864	324364.42	1532.723	5483.403
5947.4944	243019.42	1908.816	3169.69
7935.2464	412909.06	367.8724	1376.41
3620.4289	77439.758	4173.16	3432.788
4946.3089	367733.09	2300.162	7377.092

Table 2 shows the Squire Rote of matrix value.

TABLE 3. Fuzzy Significance

Importance	**Symbol**	**l**	**m**	**u**
Very little	EL	0	0	0.1
Very little	VL	0	0.1	0.3
Low	L	0.1	0.3	0.5
Medium	M	0.3	0.5	0.7
High	H	0.5	0.7	0.9
very high	VH	0.7	0.9	1
Very high	EH	0.9	1	1

Table 3 shows the ambiguity significance Subjectivity of the decision maker regarding the importance of weights Collect ratings. The following table using the subjective evaluations of the decision maker basically fuzzy significance coefficients or calculate the weights equations.

TABLE 4. The criteria's on a linguistic scale

	DM1	DM2	DM3
M1	EH	VL	M
M2	L	EH	VH
M3	L	M	VH
M4	L	M	VL

Table 4 shows the criteria's on a linguistic scale.

TABLE 5. Selected ambiguities The Linguistics of Decision Makers Using Convert estimates to quantitative values number

	DM1			DM2			DM3		
M1	0.9	1	1	0	0.1	0.3	0.3	0.5	0.7
M2	0.1	0.3	0.5	0.9	1	1	0.7	0.9	1
M3	0.1	0.3	0.5	0.3	0.5	0.7	0.7	0.9	1
M4	0.1	0.3	0.5	0.3	0.5	0.7	0	0.1	0.3

Table 5 shows the Using the selected Linguistic evaluations of decision makers convert to quantitative values fuzzy number**.**

TABLE 6. Calculate aggregated Fuzzy weights

	L-FW	M-FW	U-FW
M1	0.40	0.53	0.67
M2	0.57	0.73	0.83
M3	0.37	0.57	0.73
M4	0.13	0.30	0.50

Table 6 shows the Calculate aggregated Fuzzy weights food, water, Antibiotics, agriculture Land.

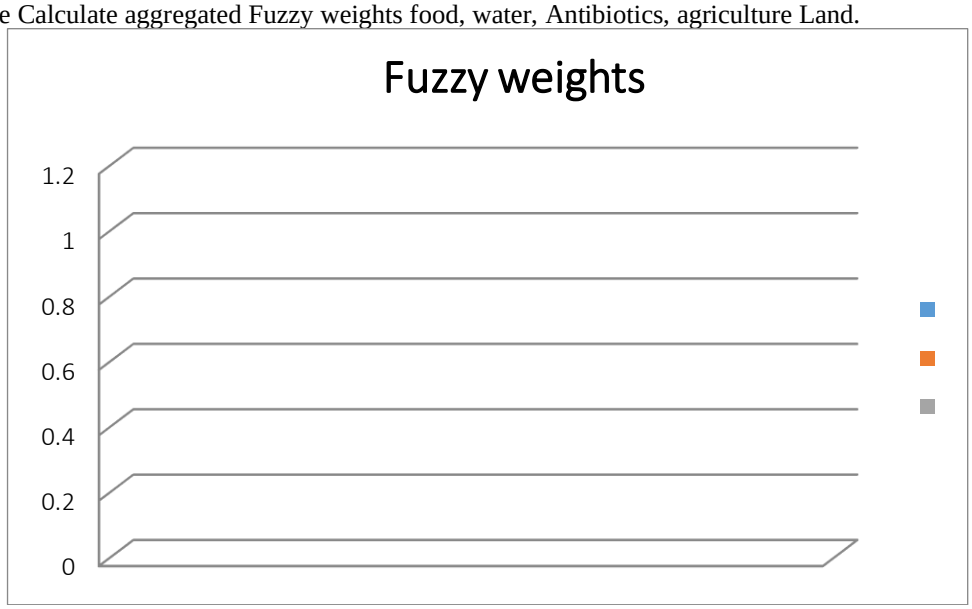

FIGURE 2. Fuzzy weights

Figure 2 shows the graphical representation the aggregated Fuzzy weights food, water, Antibiotics, agriculture Land.

TABLE 7. Normalized Data

Normalized Data			
Factorial designs	ANNs	GA	RSM
0.413676	3.460646799	0.38608	0.512958981
0.468606	2.995443704	0.430852	0.390001224
0.541279	3.90452201	0.189145	0.25699903
0.365612	1.690918461	0.637057	0.405864506
0.427348	3.684741498	0.472961	0.594977

Table 7 Normalized Data shows the Alternative: Factorial designs, ANNs, GA, and RSM. Evaluation Option: Computational time, Experimental domain, Model developing, Availability in software, Optimization Accuracy level. The Normalized data is calculated from the data set value is divided by the sum of the square root of the column value.

TABLE 8. Weighted normalized decision matrix

Weighted normalized decision matrix											
Factorial designs			ANNs			GA			RSM		
0.16547	0.220627	0.275784	1.961033	2.537808	2.883872	0.141563	0.218779	0.283125	0.068395	0.153888	0.256479
0.187442	0.249923	0.312404	1.697418	2.196659	2.496203	0.157979	0.244149	0.315958	0.052	0.117	0.195001
0.216511	0.288682	0.360852	2.212562	2.863316	3.253768	0.069353	0.107182	0.138706	0.034267	0.0771	0.1285
0.146245	0.194993	0.243741	0.958187	1.240007	1.409099	0.233588	0.360999	0.467175	0.054115	0.121759	0.202932
0.170939	0.227919	0.284898	2.08802	2.702144	3.070618	0.173419	0.268011	0.346838	0.07933	0.178493	0.297489

Table 8 Shows the Weighted normalized decision matrix Fuzzy weighted decision matrix by multiplying the normalized matrix with corresponding fuzzy weight.

TABLE 9. A+ & A-

A+	0.216511	0.288682	0.360852	2.212562	2.863316	3.253768	0.069353	0.107182	0.138706	0.034267	0.0771	0.1285
A-	0.146245	0.194993	0.243741	0.958187	1.240007	1.409099	0.233588	0.360999	0.467175	0.07933	0.178493	0.297489

Table 8 Shows the A+ Maximum, minimum value & A- Minimum, Maximum value.

TABLE 10. FPIS

	Computational time	0.069458	0.319398	0.113321	0.088393
	Experimental domain	0.039558	0.654143	0.139084	0.045931
	Model developing	0	0	0	0
	Availability in software	0.095621	1.592838	0.257739	0.051409
FPIS	Optimization Accuracy level	0.062016	0.158147	0.163314	0.116717

Table 10 shows the coordinates for the fuzzy positive ideal solution (FPIS).

TABLE 11. FNIS

	Computational time	0.026163	1.273439	0.144418	0.028324
	Experimental domain	0.056063	0.938694	0.118655	0.070786
	Model developing	0.095621	1.592838	0.257739	0.116717
	Availability in software	0	0	0	0.065308
FNIS	Optimization Accuracy level	0.033605	1.434691	0.094425	0

Table 11 shows the coordinates for the fuzzy Negative ideal solution (FNIS).

TABLE 12. Si+ & Si-

Si+	Si-
0.590571	1.472344
0.878716	1.184198
0	2.062914
1.997606	0.065308
0.500194	1.56272

Table 12 Shows the Euclidean distance of each alternative from positive and negative value calculated as. Where represents the distance between two fuzzy numbers calculated by S+, S- value.

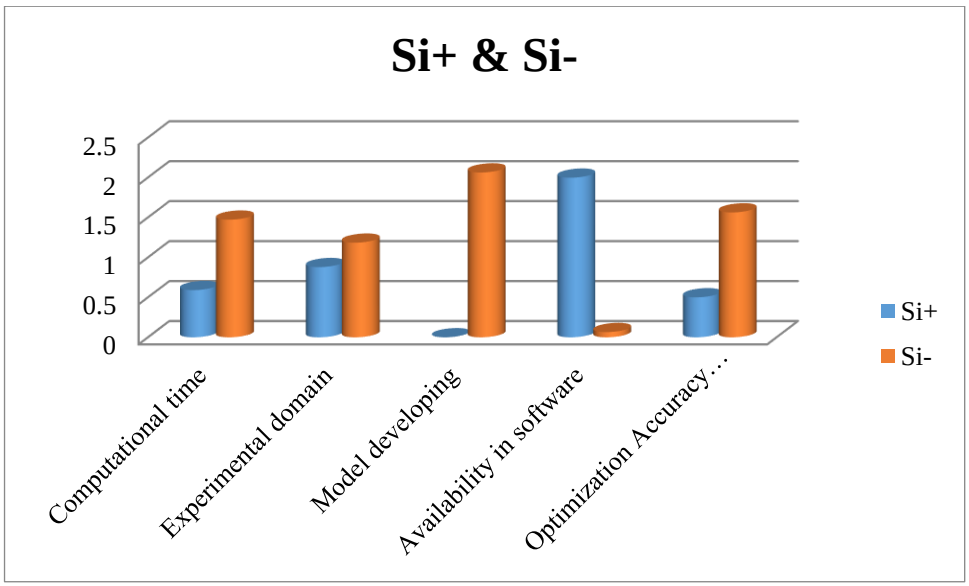

Figure 3 shows the graphical representation S+, S- value

TABLE 13. Rank

	Cci	Rank
Computational time	0.71372	3
Experimental domain	0.574041	4
Model developing	1	1
Availability in software	0.031658	5
Optimization Accuracy level	0.75753	2

Table 13 shows the closeness coefficient CCi of the alternatives are calculated using equation ranked as per descending order. the final result of this paper the Model developing is in 1st rank, the Optimization Accuracy level is in 2nd rank, the Computational time is in 3rd rank, the Experimental domain is in 4th rank and the Availability in software is in 5th rank. The final result is done by using the Fuzzy TOPSIS method.

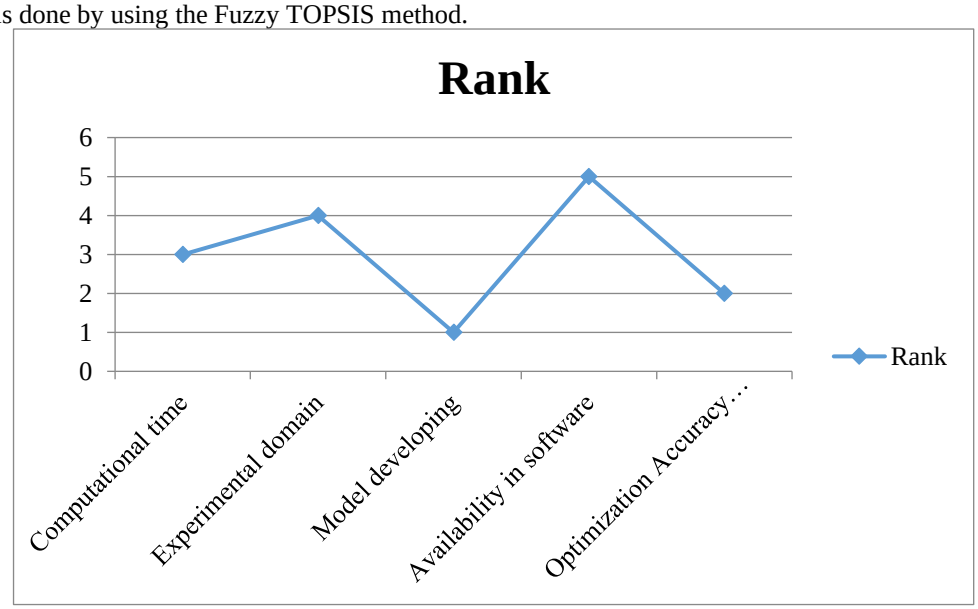

FIGURE 4. Rank

Figure 4 shows the from the result it is seen that Model developing and is got the first rank whereas is the Availability in software got is having the lowest rank.

Conclusion

From the result it is seen that Model developing and is got the first rank whereas is the Availability in software got is having the lowest rank. Offering immediate benefits to manufacturing companies, FW machines have seen a surprising over the past few years, China and Inquiries from South Asia have increased. To achieve this important goal, welded joints are New to describe the evolution of structure and properties, A very reliable and efficient process assistant Model and reliable sub-models are needed. Current FSW process sub-models are complex, Take time, and are used in real-time cannot. at the same time evaluate our modeling skills. At welding temperature and forces acting on the pin Parametric studies to determine the effect of tool speed have been conducted. The current one the tool is limited to geometry because Effect of tool geometry on the welding process The investigation is very much due to the complexity of the pin geometry It will be difficult. Test for this type of welds Results Predicted temperatures from the numerical model are used to check. To relieve the residual stress caused by this, welding The process causes the structure to warp and disintegrate. There are many methods of decomposition, but very common, especially thin welded In structures, bending deformation is the parent Stress is caused by stress on the material. Bucking Due to which distortion is becoming more common Trapezoidal hesitation fuzzy set, trapezoidal hesitation intuitionist fuzzy set, Interval-valued trapezoidal reluctance is intuitive Fuzzy number, trapezoidal Fuzzy number, trapezoidal Interval Hesitation Intuitive Fuzzy Topsis method, interval-valued trapezoidal Reluctance is an intuitive fuzzy topsis method and Comment cubzyicsoidal fuzyidation Introducing.

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