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A Review on Evaluation of MIG Welding Process Parameter by using MOORAS Method

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***Abstract:** This review paper focus on Parametric optimization in Metal inert gas welding by using MOORAS method. MIG is arc welding process. Parameters optimization can be done by Multi-objective optimization on basis of ratio analysis and analytical Heriachy process. Ranking of alternatives determine by attributes weight or related importance given between attributes and on the values of the selected attributes,MOORA method is very fast and robust. It needs minimum Mathematical calculations and calculations time. Review paper endeavor process to illustrate problem by MOORAS method.*

I. INTRODUCTION

Welding is joining process in which two or more material are joined together by means of heat or compression. Metal Inert Gas welding is an arc welding process in which the wire acts as a electrode and feed through spool. Sheilding gas is feed through welding gun, Sheilding gas can be active gas such as argon oxygen mixture ,carbon argon mixture or it can be argon inert gas. MIG welding can be used on most of metal such as mild steel, Stainless steel, Alloy steel and Aluminium. MIG welding is used in production of automobile chasis, pressure vessel, boilers, manufacturing of various machine. In this paper we are going to review on different parameters of MIG welding such as Current, Voltage, Gas flow rate, wire feed speed, flux used.

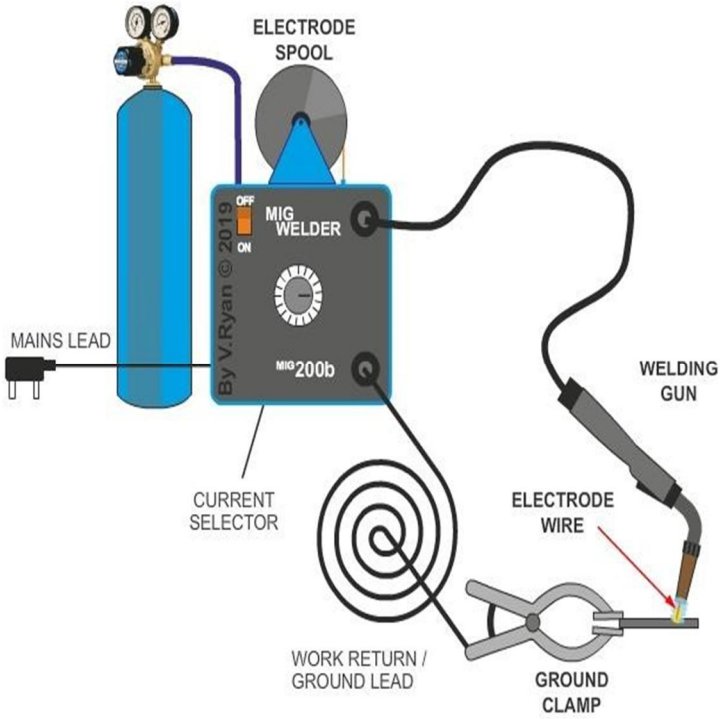

Fig. 1 MIG welding setup

I.A. Analytic Hierarchy Process (AHP)/ multi objective optimization on the basis of ratio analysis (MOORA)

The Analytical Hierarchy process is an higher cognitive decision making method to solve multi-dimensional and compound problems principles of AHP are as follows: structure of the model; comparative judgment of the criteria and/or alternatives; synthesis of the priorities.

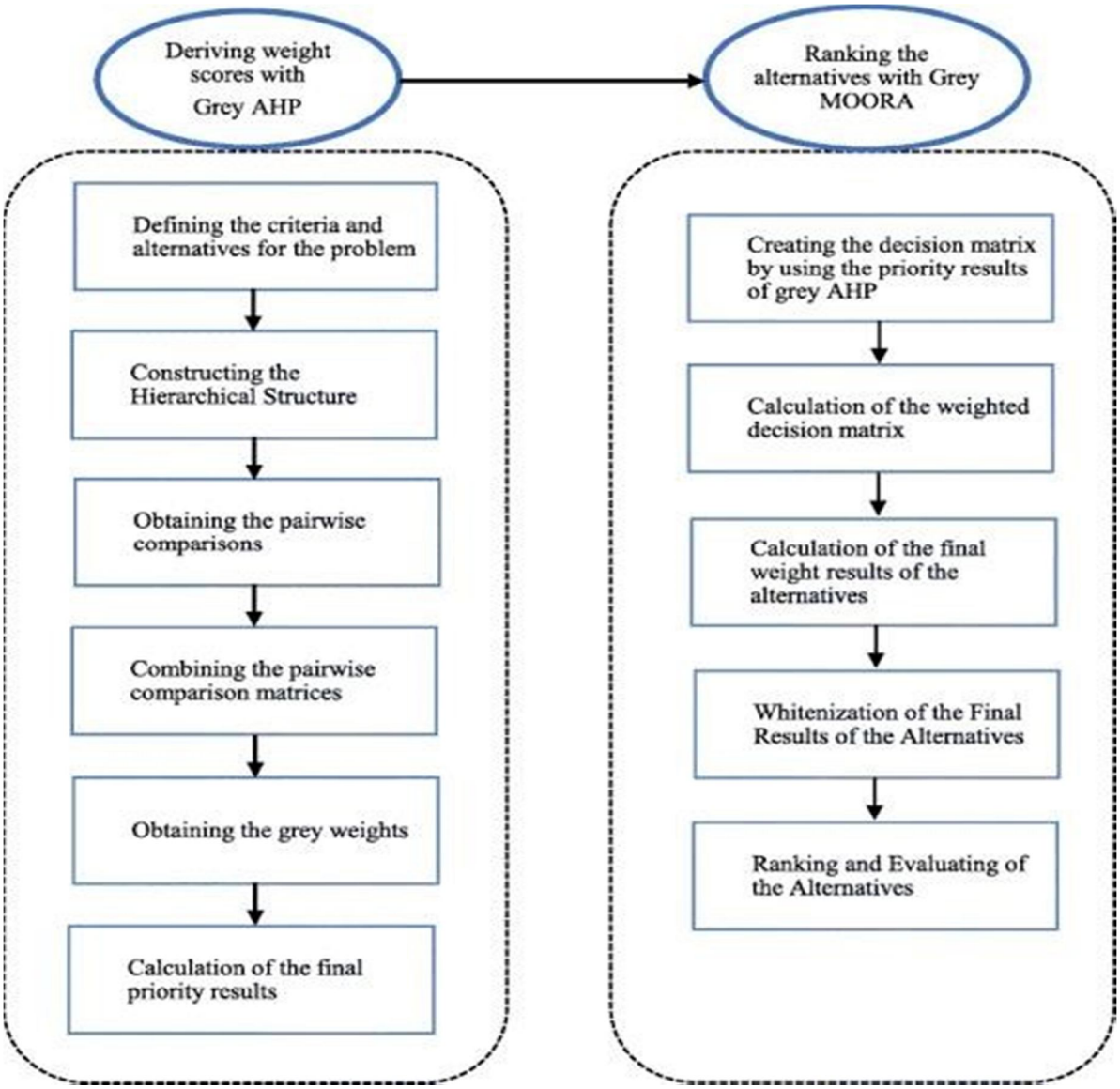

Fig. 2 Flow chart for MOORAS method

1) *Step 1:* Developing the hierarchical structure. A decision problem is structured as a hierarchy structure With the AHP, the goal, conclusion criteria and alternatives are arranged in a hierarchical structure similar to family structure..

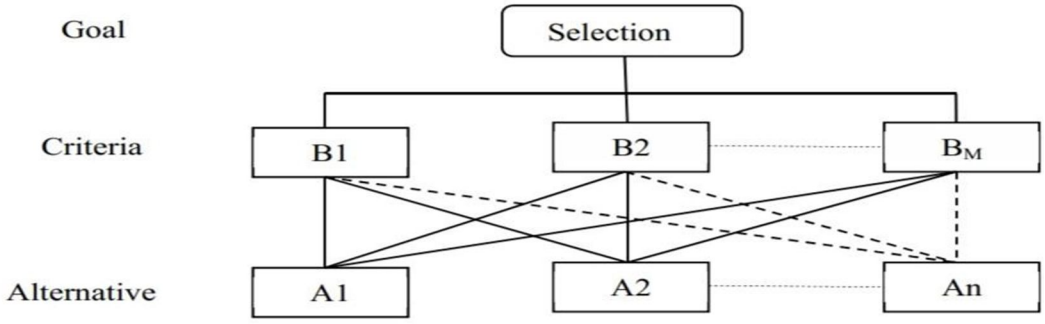

Fig. 3 Hierarchy of decision making problem

2) *Step 2:* Perform the pair wise comparisons. In this step, differentiation matrices are formed and pair Wise

$$A1_{MxM} = \begin{array}{c} \\ B1 \\ B2 \\ B3 \\ - \\ - \\ BM \end{array} \begin{bmatrix} 1 & a_{12} & a_{13} & -- & -- & a_{1M} \\ a_{21} & 1 & a_{23} & -- & -- & a_{2M} \\ a_{31} & a_{32} & 1 & -- & -- & a_{3M} \\ -- & -- & -- & 1 & -- & -- \\ -- & -- & -- & -- & 1 & -- \\ a_{M1} & a_{M2} & a_{M3} & -- & -- & 1 \end{bmatrix}$$

Differentiation are conducted. Conclusions criteria are compared in the corresponding level using scale of importance. Where aij denotes the related importance of attribute i with respect to attribute j and Bi denoted the standard in the matrix, aij = 1, wheni = j and aji =1/aij.

Scale	Importance	Meaning of attributes
1	Equal importance	Two attributes are equal important
3	Moderate importance	One attributes is moderately important on other
5	Strong importance	One attribute is strongly important over other
7	Very strong importance	One attribute is very strongly important over other
9	Absolute importance	One attribute is absolutely important over other
2,4,6,8 compromise importance between 1,3,5,7,9		

Table. 1 Scale of Importance

3) *Step 3:* Determination of relative normalized weight. A relative normalized weight is calculated at each level of hierarchy structure by using Equation (1) and Equation (2).

$$GM_j = [\pi_{j=1}^{M} a_{ij}]^{\frac{1}{M}} \quad \ldots\ldots (1)$$

$$W_j = \frac{GM_j}{\sum_{j=1}^{M} GM_j} \quad \ldots\ldots\ldots\ldots (2)$$

4) *Step 4:* Consistency Test.

a) *CALCULATE MATRICES*

A3 = A1 x A2 and A4 = A3 ÷A2

Where; A1= [aij] M×M

A2 = [W1,W2,W3,…Wj]T o Calculate Eigen values ƛmax(average of matrix A4) o Calculate consistency index:CI = (ƛmax- M) / (M - 1)

b) *Calculate consistency ratio CR = CI/RI, select value of random index*

(RI) according to number of imputes used in decision-making.

If CR < 0.1, considered as allowable decision, otherwise judgment of the Researchers about the problem is under study.

5) *Step-5:* Find the dimensionless number or normalization value.

Let Rijis a dimensionless number which belongs to the interval [0, 1]. It can be given as follows:

$$R_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij^2}}}$$

… .. … .. . (3)

6) *Step-6:* Determine the normalized presentation of alternative. In this step, the normalized presentation of alternatives is determined with considering weight age of selection criteria involved in the decision making process. For multi-objective optimization, these normalized presentation are added in case of high(for beneficial attributes) and subtracted in case of low (for non beneficial attributes).

$$y_i = \sum_{j=1}^{g} W_j X_{ij} - \sum_{j=g+1}^{n} W_j X_{ij_{(j=1,2,\ldots\ldots..n)}} \quad .. \ldots .. (4)$$

Step-7: Ranking and selection of alternative.

The value of yi value can be positive or negative depending of The totals of its highesr(beneficial attributes) and lowest (nonbeneficialattributes), A ranking of alternative will be carried out based on value of y and finally, the superior alternative is considered who has the highest y value or ranked first while the inferior alternative has the lowest yi value or ranked last.

II. LITERATURE SURVEY

Adeniran Sunday Afolalu, Omolayo M. Ikumapayi[1] have examined that on application of Feo based nano flux on M.S plate in MIG welding leads to increase in hardness and tensile strength of material, but without application of welding flux it can not give us hardness and tensile strength as same of flux applied on material

Saadat Ali Rizvi and S. P. Tewari[2] authors optimize the gas metal arc welding parameters on stainless steel 304 by using taguchi grey relations analysis . Best parameters obtained where voltage = 23V, gas flow rate = 25l/min, and wire feed speed = 350IPM., they concluded that wire feed has notebale effect than that of gas flow rate.

Suha K. Shihaba, Noor Zaman Khan[3]studied process parameters such current, voltage, and torch on SS316. MOORAS method was applied for favourable welding parameters that requires less time and power for cladding.

Favourable parameters required for cladding was current 30A, voltage 260V and the torch angle 45°.

Pavan G. Chaudhari , Priyank B.Patel, Jaksan D. Patel[4]concluded the priority or ranking of alternatives depends on attributes weight or relative importance assigned between attributes and on the values of the selected attributes,MOORA method is very fast and robust. It requires less Mathematical calculations and computational time.

Joseph Achebo[5] This study summarily covers the application of MOORA method in the selection of optimized welding process parameters for welding mild steel plates using the gas metal arc welding techniques. This multiobjective optimization tool utilizes a ranking method for the process parameters selection process.

Priyanka Devidas Shinde, Prof. K. R. Madavi[6]welding was performed on fe410 ,author focused on significant parameters such as penetration and UTS, from experiment results and taguchi optimization technique it was noticed that for better penetration and UTS parameters should be at following range, current=210A, Voltage=25V, Gas flow rate=19 Lit/min for penetration and for UTS current=180A, Voltage=30V, Gas flow rate=17 Lit/min.Important parameters is current followed by Voltage.

Nakul Agwan,Saili Kulkarni,Akshay Harkal[7]MSE34 plates was welded by MIG welding process at varying current and types of flux. In this experimentation researchers lastly concluded that current is important parameter followed by flux. Best parameters for penetration are 110 amp Current, SiO2 flux and 12 lit/ min of gas flow rate.

Zong-Liang Lianga, Tae-Jong Yuna, Won-Bin Oha[8]in this study parameters chosen were as follows: welding current, arc voltage, welding speed, CTWD and the response Considered are bead width, bead height and hardnessof the weldments. From the results obtained, important welding parameters are welding Current 135A, arc voltage 18V, welding speed 800mm/min, CTWD18mm which obtained by analysis results of S/N Ratio analysis for essential parameters to minimize bead width and bead height and maximize hardness of the

Weldments simultaneously. The experiment results confirm the validity of the optimal results obtained so that MOORA method has successfully optimized the welding parameters considered in this study.

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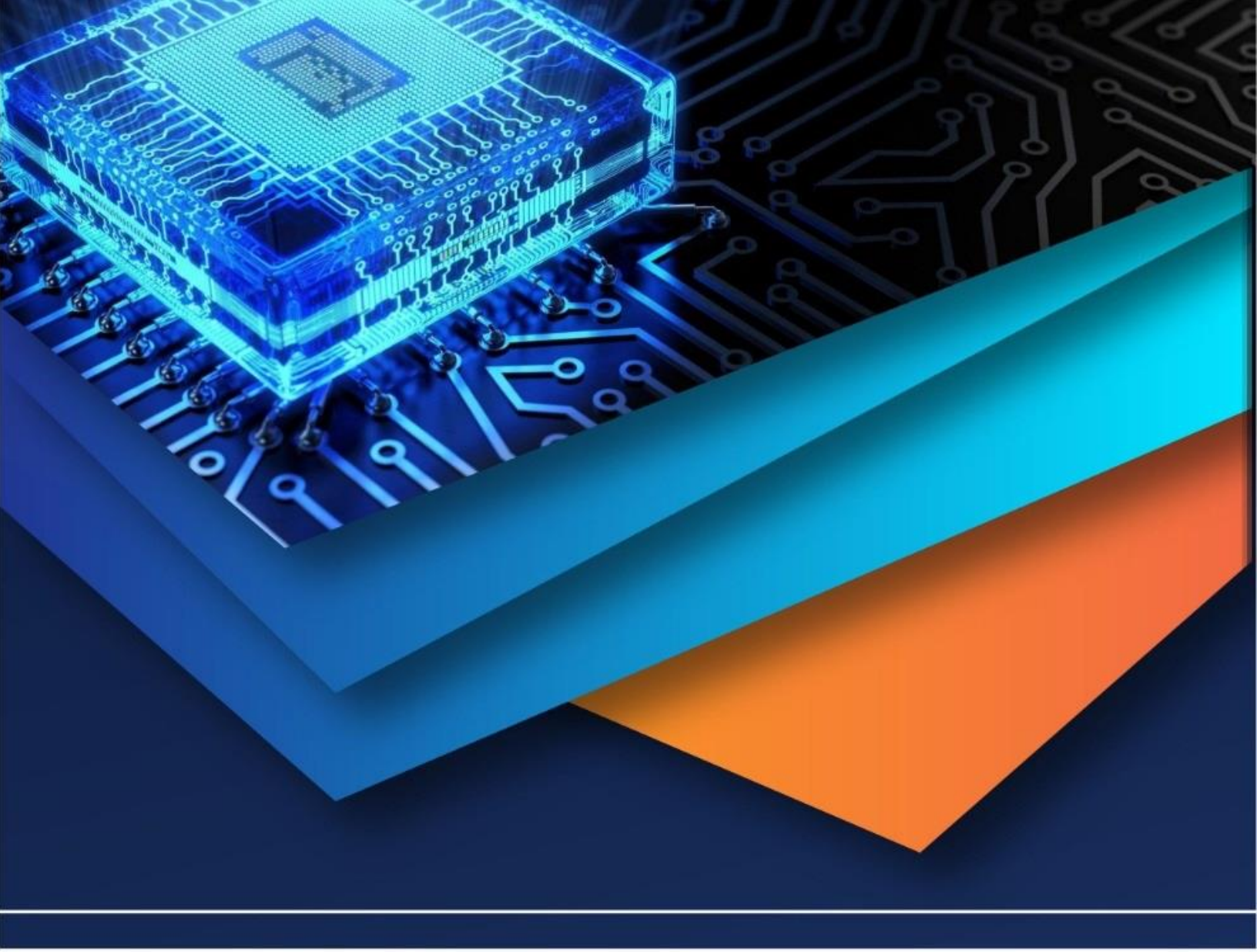

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