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Using entropy weight, OEC and fuzzy logic for optimizing the parameters during EDM of Al-24 % SiC_P MMC

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ABSTRACT

In this paper the multiple methodologies are used viz. Entropy weight measurement, Overall evaluation criteria (OEC), and fuzzy logic for optimizing the process parameters during Electrical discharge machining (EDM) process of Al-24 % SiC_P metal matrix composite (MMC). Three process parameters like as peak current, pulse on time and flushing pressure are considered as input variables whereas material removal rate, tool wear rate, radial over cut and surface roughness are response variables. Central composite design (CCD) is used as the design of experiment (DoE) for conducting the experiments using different combinations of input variables of three levels for predicting responses. The individual weightage of each response is calculated using the Entropy weight method and normalization of responses were carried out with the same weightage of responses using OEC. Finally fuzzy logic was used to obtain a single numerical index known as the Multi performance characteristics index (MPCI). The Analysis of Variance (ANOVA) was used to find the significances of process parameters on the responses. The second-order mathematical model was developed using response surface methodology for predicting the results. Moreover, a confirmation test was carried out to check the effectiveness of the presented approach.

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Izvirni znanstveni članek

Uporaba utežene entropijske metode, metode OEC in mehke logike za optimizacijo parametrov med elektroerozijsko obdelavo Al-24 % SiC_P kompozita s kovinsko osnovo

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POVZETEK

V prispevku smo uporabili več pristopov za optimizacijo procesnih parametrov pri elektroerozijski obdelavi (EDM) kompozita s kovinsko osnovo (MMC) Al-24 % SiC_P, in sicer uteženo entropijsko metodo, metodo splošne ocenitve kriterijev (OEC) in mehko logiko. Vhodne spremenljivke so bile največji tok, čas trajanja impulza in tlak dielektrične tekočine, izhodne oziroma odzivne spremenljivke pa stopnja odvzema materiala, obraba orodja, radialni *overcut* in hrapavost površine. Uporabljena je bila centralna kompozitna shema (CD) kot načrtovanje eksperimentov (DoE) za izvedbo preizkusov z različnimi kombinacijami vrednosti vhodnih spremenljivk v treh nivojih. Utežen odziv za vsako izhodno spremenljivko je bil izračunan s pomočjo utežene entropijske metode, normalizacija izhodov pa je bila izvedena z enakimi utežmi z uporabo metode OEC. Na koncu je bila uporabljena mehka logika, s čimer je bil dobljen posamezni numerični indeks, znan kot indeks zmogljivosti več značilnosti (MPCI). Za analizo vplivnosti procesnih parametrov na izhodne spremenljivke smo uporabili analizo variance (ANOVA). Z metodo odzivnih površin smo razvili matematični model drugega reda s katerim smo napovedovali vrednosti odzivov. Narejen je bil še potrditveni test za preverjanje učinkovitosti predstavljenega pristopa.

PODATKI O ČLANKU

Ključne besede:
Electrical discharge machining
Aluminijev MMC
Utežena entropijska metoda
Splošna ocenitev kriterijev
Mehka logika

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