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A grey-fuzzy approach for optimizing machining parameters and the approach angle in turning AISI 1045 steel

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ABSTRACT

The influence of the machining parameters and approach angle of carbide inserts over tool wear at the flank face, surface roughness and material removal rate are investigated experimentally in this work. The optimum conditions are found out by using a hybrid grey-fuzzy algorithm. The grey relational analysis and fuzzy logic technique are coupled to obtain a grey-fuzzy grade for evaluating multi-characteristics output from the grey relational coefficient of each response. The experiments were designed using Taguchi's design of experiments; a L_9 (3^4) orthogonal array was selected for four parameters varied through three levels. Fuzzy-based reasoning was integrated using the grey approach to reduce the degree of uncertainty. The optimal setting was found out by a response table and the influences of input parameters on the output were determined by Analysis of variance. With the help of this hybrid technique the performance characteristics of the machining process were improved, which is proved by the results from the confirmation experiment.

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Izvirni znanstveni članek

Sivo-mehki pristop za optimizacijo obdelovalnih parametrov in vstopnega kota pri struženju jekla AISI 1045

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POVZETEK

V članku je raziskan vpliv obdelovalnih parametrov in vstopnega kota karbidnih stružnih ploščic na obrabo orodja na cepilni ploskvi, površinsko hrapavost in stopnjo odvzema materiala. Optimalne obdelovalne razmere smo dosegli z uporabo hibridnega sivo-mehkega algoritma, v katerem smo združili sivo relacijsko analizo in mehko logiko. S hibridnim pristopom smo ovrednotili izhod, ki ima več značilnosti oziroma izhodnih spremenljivk. Eksperiment je bil načrtovan v skladu z Taguchijevo metodo načrtovanja eksperimentov: uporabljena je bila L_9 (3^4) ortogonalna matrika, in sicer za štiri parametre in tri nivoje vrednosti. Da bi zmanjšali stopnjo negotovosti smo vgradili sklepalni mehanizem, temelječ na osnovi mehke logike. Optimalne nastavitve smo dobili s pomočjo tabele odzivov. Vpliv vhodnih parametrov na izhod smo določili z analizo variance. S pomočjo eksperimentov za verificiranje smo potrdili, da hibridni pristop omogoča izboljšavo obdelovalnega postopka.

PODATKI O ČLANKU

Ključne besede:
Obdelovalni parametri
Vstopni kot
Siva relacijska analiza
Mehka logika
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