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ORIGINAL ARTICLE

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Investigation for optimal parametric combination for achieving better surface finish during turning of Al/SiC-MMC

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Abstract This paper presents an experimental investigation of the influence of cutting conditions on surface finish during turning of Al/SiC-MMC. In this study, the Taguchi method, a powerful tool for experiment design,is used to optimise cutting parameters for effective turning of Al/SiC-MMC using a fixed rhombic tooling system. An orthogonal $L_{27}(3^{13})$ array is used for 3^3 factorial design and analysis of variance (ANOVA) is employed to investigate the influence of cutting speed, feed and depth of cut on the surface roughness height R_a and R_t respectively. The influence of the interaction of cutting speed/feed on the surface roughness height R_a and R_t and the effect of cutting speed on cutting speed/feed two factor cell total interaction for surface roughness height R_a and R_t are analysed through various graphical representations. Taking significant cutting parameters into consideration and using multiple linear-regression, mathematical models relating to surface roughness height R_a and R_t are established to investigate the influence of cutting parameters during turning of Al/SiC-MMC. Confirmation test results established the fact that the mathematical models are appropriate for effectively representing machining performance criteria, e.g. surface roughness heights during turning of Al/SiC-MMC.

Keywords Al/SiC-MMC · Fixed tooling system · Factorial design · Surface finish · Analysis of variance

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1 Introduction

About 30 years ago, metal matrix composites (MMCs) were introduced in the aerospace and aeronautic industries and about 15 years later, MMCs reached the automotive industry. However, MMCs are not widely used in these industries due to their poor machinability. Al/SiC-MMC is one of the important composites among MMCs, which have SiC-particles with aluminium matrix that is harder than tungsten carbide (WC). Vast and rapid progress in science, and technology, however, has led to modern industry rapidly introducing Al/SiC-MMCs that have a low density and very light weight with high temperature strength, hardness and stiffness, high fatigue strength and wear resistance in order to meet the challenge of liberalisation and to maintain global competitiveness in the market. The aluminium alloy, reinforced with discontinuous ceramic reinforcements, is rapidly replacing conventional materials in various automotive, aerospace and automobile industries [1]. But Al/SiC-MMC machining is one of the major problems which stop it from being used in widespread engineering applications [2]. Some early conventional turning tests on Al/SiC-MMCs [3, 4, 5], showed that tool wear is excessive and surface finish is very poor when carbide tip tools are used for machining. During machining of Al/SiC-MMCs, the use of coolant increases tool wear and also produces a very poor surface finish [6]. The hard SiC particles of Al/SiC-MMC, which intermittently come into contact with the hard surface, act as small cutting edges like those of a grinding wheel on the cutting tool edge, which in due course becomes worn out by abrasion, resulting in the formation of a poor surface finish during turning [7]. When an Al/SiC-MMC job slides over a hard cutting tool edge during turning it always presents a newly formed surface to the same portion of the cutting edge and consequently, due to friction, high temperature and pressure the particles of the Al/SiC-MMC, it adheres to the cutting tool edge. In this way more particles join those already adhering and a so-called built-up edge is formed. If this process is continue for some time, it appears as if the turned surface has been nibbled away and produces very poor surface finish during turning. Hence, creating a generation of good surface finishes for Al/SiC-MMC jobs during turning is a challenge to manufacturing engineers all over the world.

In view of the above-mentioned machining problems, the main objective of the paper is to study of the influence of different cutting parameters on surface finish criterion. The Taguchi design approach is utilised for experimental planning during the turning of Al/SiC-MMC. Test results are analysed to achieve optimal surface roughness heights R_a and R_t. Mathematical models are developed by means of multiple linear regression analysis for optimal selection of machining parameters for minimum surface roughness heights R_a and R_t during Al/SiC-MMC turning.

2 Planning for experimentation

Discontinuous Al/SiC-MMC of 60 mm dia. bar is used for experimentation. Table 1 shows the chemical composition of the Al/SiC-MMC used for the experimentation. Table 2 shows the physical and mechanical properties of the Al/SiC-MMC. The different sets of experiments were performed using a Kirloskar centre lathe. Table 3 represents the details of cutting tool and tooling system used for the experimentation. The machined surface was measured at three different positions and the average value was taken using a TSK surfcom 120A-type surface texture measuring instrument.

According to Taguchi method, a robust design [9, 10] and an $L_{27}(3^{13})$ orthogonal array are employed for the experimentation. Three machining parameters are considered as controlling factors (cutting speed, feed and depth of cut) and each parameter has three levels, namely small, medium and large, denoted by 1, 2 and 3. Table 4 shows the cutting parameters and their levels as considered for the experimentation. Table 5 shows the planning for experimental design considered for the investigation to achieve optimal surface finish during Al/SiC-MMC turning . The first column, second column and sixth column of the $L_{27}(3^{13})$ array were assigned to the cutting speed (A), feed (B) and depth of cut (C) respectively. Initially, 27 sets of experiments were performed according to the $L_{27}(3^{13})$ orthogonal array, each set of experiments was repeated three times, with a total of 81 experiments being conducted for the investigation.

Table 4 Cutting parameters and their levels

Sl. no.	Machining parameters	Level		
		1	2	3
1	A: cutting speed, m/min	40	100	160
2	B: feed, mm/rev	0.16	0.32	0.48
3	C: depth of cut, mm	0.50	0.75	1.00

3 Mathematical models for R_a and R_t

Table 6 shows the sets of experiments of $L_{27}(3^{13})$ orthogonal array with experimental results of surface roughness height R_a and maximum peak-to-valley height of surface roughness R_t along with their arithmetic average values. Table 7 and Table 8 show the result of the analysis of variance (ANOVA) for surface roughness height R_a and R_t, respectively. The analysis of

Table 1 Composition of Al/SiC-MMC used for experiment

Types of MMC	Types of reinforced particles	% SiC	% Si	% Mg	% Fe	% Cu	% Mn	% Zn	% Ti	Al
Discontinuous MMC	SiC APS: 45 μm	10.00	7.01	0.60	0.12	0.18	0.10	0.10	0.10	Remaining

Table 2 Physical and mechanical properties of Al/SiC-MMC

Material	Density (gm/cm^3)	Tensile strength (Mpa)	Yield strength (Mpa)	% of elongation	Hardness (BHN)	Modulus of elasticity (Gpa)
LM25 Mg 10SiC_P	2.69	295	260	1.5–2	105	95

Table 3 Details of cutting tool and tooling system used for experimentation

Tooling system	Condition of machining	Cutting tool used	Cutting tool specification	Tool material and grade	Rake angle	Clearance angle	Nose radius	Cutting edge angle	Cutting fluid used
Fixed rhombic tooling (FRT)	Turning	T-Max-U Positive rhombic insert	CCGX 09 T3 04 Al-H 10	Uncoated tungsten carbide (WC) (HW-K10)	5°	7°	0.4 mm	80°	Not used

Table 5 Design experiment of Taguchi $L_{27}(3^{13})$ orthogonal array

Expt. no	Column					
	Coded level			Actual setting value		
	1	2	6	1	2	6
1	1	1	1	40	0.16	0.50
2	1	1	2	40	0.16	0.75
3	1	1	3	40	0.16	1.00
4	1	2	1	40	0.32	0.50
5	1	2	2	40	0.32	0.75
6	1	2	3	40	0.32	1.00
7	1	3	1	40	0.48	0.50
8	1	3	2	40	0.48	0.75
9	1	3	3	40	0.48	1.00
10	2	1	2	100	0.16	0.50
11	2	1	3	100	0.16	0.75
12	2	1	1	100	0.16	1.00
13	2	2	2	100	0.32	0.50
14	2	2	3	100	0.32	0.75
15	2	2	1	100	0.32	1.00
16	2	3	2	100	0.48	0.50
17	2	3	3	100	0.48	0.75
18	2	3	1	100	0.48	1.00
19	3	1	3	160	0.16	0.50
20	3	1	1	160	0.16	0.75
21	3	1	2	160	0.16	1.00
22	3	2	3	160	0.32	0.50
23	3	2	1	160	0.32	0.75
24	3	2	2	160	0.32	1.00
25	3	3	3	160	0.48	0.50
26	3	3	1	160	0.48	0.75
27	3	3	2	160	0.48	1.00

variance was carried out for a 95% confidence level. The ANOVA Tables 7 and 8 show that, with the exception of the ABC interaction in R_a (Table 7) and the BC interaction in R_t (Table 8), the F_0 value corresponding to all parameters and also corresponding to the all of the two-factor/three-factor interactions are greater than the tabulate value of $F_{0.05}$. The main purpose of the analysis of variance is to investigate the influence of design parameters on optimal surface finish by indicating the parameters that significantly affect the quality characteristics of the machined surfaces. This analysis provides the relative contribution of machining parameters in controlling the response of machining performance criteria, e.g. surface roughness height R_a and maximum peak-to-valley height of surface roughness R_t during Al/SiC-MMC turning .

Table 7 shows that the cutting speed ($P=26.89\%$), feed ($P=27.14\%$), and depth of cut ($P=27.31\%$) are equally responsible and have a great influence on surface roughness height R_a (μm). The interaction of cutting speed/feed is the second influencing factor on the surface roughness height R_a. Table 8 shows that the depth of cut ($P=39.88\%$), feed ($P=33.63\%$) and cutting speed ($P=10.94\%$) are the most significant, significant and less significant influencing factors on the surface roughness height R_t during turning of Al/SiC-MMC. Table 8 also shows that the two-factor interaction of cutting speed/ feed, and three-factor interaction between cutting speed/feed/depth of cut have a much less significant effect on surface roughness height R_t. The two-

Table 6 Experimental results for R_a and R_t

Exp. No.	Test results of R_a (μm)			Test results of R_t (μm)			Average R_a	Average R_t
	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6		
1.	1.88	1.99	2.14	11.78	12.12	12.28	2.01	12.06
2.	2.32	2.70	3.02	17.43	17.99	17.60	2.68	17.67
3.	3.31	3.18	3.36	23.18	22.69	23.25	3.28	23.04
4.	3.04	2.71	2.69	14.76	16.19	14.29	2.81	15.08
5.	3.13	3.51	3.08	18.22	18.46	20.84	3.24	19.17
6.	4.05	3.87	3.45	25.07	26.24	24.92	3.79	25.41
7.	4.11	3.92	3.96	26.85	26.18	27.43	3.99	26.82
8.	3.95	3.98	4.23	26.59	30.09	27.89	4.05	28.19
9.	4.61	4.44	3.82	31.74	31.13	28.99	4.29	30.62
10.	1.90	1.84	1.66	9.99	10.15	8.36	1.80	9.48
11.	2.07	2.31	3.09	14.71	10.85	14.13	2.49	13.23
12.	2.84	3.23	3.27	22.08	26.59	23.61	3.11	24.09
13.	2.05	2.01	1.92	12.97	12.58	11.73	1.99	12.43
14.	2.66	2.31	3.34	16.38	20.01	19.92	2.77	18.77
15.	3.22	3.01	3.31	23.64	25.12	21.86	3.16	23.54
16.	1.98	2.06	2.05	12.18	12.42	12.24	2.03	12.28
17.	3.58	3.14	3.96	23.04	23.64	22.81	3.56	23.16
18.	3.42	3.61	3.89	30.16	24.78	29.16	3.64	28.03
19.	1.06	1.87	1.60	8.10	8.14	8.09	1.51	8.11
20.	1.91	1.54	1.59	9.05	8.88	8.75	1.68	8.89
21.	1.76	1.62	1.99	11.16	11.29	11.18	1.79	11.21
22.	2.01	1.48	1.94	11.15	11.02	10.77	1.81	10.98
23.	2.08	2.05	2.29	17.88	‘17.96	17.60	2.14	17.81
24.	2.99	3.17	2.87	23.82	24.54	24.29	3.04	24.22
25.	1.74	2.04	1.84	14.20	13.83	14.33	1.87	14.12
26.	2.98	2.76	3.96	24.58	24.28	24.16	3.26	24.34
27.	3.66	3.11	3.52	28.25	28.58	28.63	3.43	28.49

Table 7 ANOVA for Ra

Source of variation	Sum of squares	Degrees of freedom	Mean square (mm/min)	F_0 tests	F at 5%	Contribution P (%)
A: cutting speed (m/min)	15.76	2	7.88	93.63	3.15	26.89
B: feed rate (mm/rev)	15.91	2	7.96	93.53	3.15	27.14
C: depth of cut (mm)	16.01	2	8.01	94.12	3.15	27.31
AB	3.06	4	0.76	8.98	2.53	5.22
AC	1.01	4	0.25	2.96	2.53	1.72
BC	1.17	4	0.29	3.43	2.53	2.00
ABC	1.11	8	0.14	1.63	2.10	1.89
Error	4.59	54	0.09	–	–	7.83
Total	58.62	80	–	–	–	100.00

Table 8 ANOVA for *Rt*

Source of variation	Sum of squares	Degrees of freedom	Mean square	F_0 tests	F at 5%	Contribution P (%)
A: Cutting speed (m/min)	430.41	2	215.21	100.10	3.15	10.94
B: Feed rate (mm/rev)	1332.90	2	661.45	307.65	3.15	33.63
C: Depth of cut (mm)	1569.01	2	784.51	364.89	3.15	39.88
AB	181.75	4	45.44	21.13	2.53	4.62
AC	71.97	4	17.99	8.37	2.53	1.83
BC	14.53	4	3.63	1.69	2.53	0.37
ABC	227.61	8	28.45	13.23	2.10	5.79
Error	115.84	54	2.15	–	–	2.94
Total	3934.02	80	–	–	–	100.00

factor interactions of cutting speed/depth of cut and feed/depth of cut have no significant effect on surface roughness height R_t.

Finally, considering the most significant parameters, i.e. cutting speed (factor A), feed (factor B) and depth of cut (factor C) with notation of 'V_c', 'f' and 'd' respectively, and with the help of the test results for R_a and R_t from Table 6, mathematical models can be developed for the effective surface finish criteria, e.g. R_a and R_t during machining of Al/SiC-MMC. Using multiple linear regression and correlation analysis, mathematical models for R_a and R_t are obtained as follows:

$$R_a = 0.965148 - 0.00889541\,Vc + 3.401852\,f + 2.1579013\,d$$

$$R^2 = 0.92 \quad (1)$$

and

$$R_t = -2.4807225 - 0.0461962\,Vc + 30.6239571\,f + 21.6077932\,d$$

$$R^2 = 0.97 \quad (2)$$

Where,

V_c cutting speed, m/min.
f feed, rev/min.
d depth of cut, mm.

Table 9 Cutting condition for confirmation test

Confirmation test number	Cutting speed (m/min.) factor, A	Feed (mm/rev) factor, B	Depth of cut (mm) factor, C
1	280	0.50	0.50
2	130	0.32	0.75
3	60	0.16	1.00

3.1 Confirmation test for mathematical models

After identifying the most effective parameter for optimal surface finish, the final stage is to predict and verify the improvement in the quality characteristics for machining of Al/SiC-MMC during turning with respect to the chosen initial or reference parameter setting. Table 9 shows the chosen cutting condition used for the turning operation for the confirmation test. Considering the cylindrical finish turning operation, the predicted optimal value of surface roughness height R_a and R_t can be calculated from the theoretical geometric models [11, 12] as follows:

$$R_a = \left(\frac{0.032\,f^2}{8\,r}\right) \times 100 \quad (3)$$

and

$$R_t = \left(\frac{f^2}{8\,r}\right) \times 1000 \qquad (4)$$

Where,

f' feed, mm/rev.

r nose radius, mm.

Table 10 and Table 11 show the predicted and actual machining results of R_a and R_t obtained experimentally using the developed mathematical models Eqs. 1 and 2, and theoretical geometric model Eqs. 3 and 4. Tables 10 and Table 11 show that the percentage of error is always much less when the result is obtained using developed mathematical models as compared to that of the results obtained using theoretical models. From the above discussion and confirmation test results it can be concluded that the developed mathematical models for optimal machining performance, i.e. surface roughness height R_a and R_t during turning of Al/SiC-MMC agree well with the experimental test lines. The above mathematical models for obtaining optimal surface finish are of great importance for the proper selection of machining parameters during Al/SiC-MMC turning in practical manufacturing industries.

4 Experimental results and discussion

Figure 1 shows the influence of cutting speed on the average surface roughness height R_a and R_t during turning of Al/SiC-MMC. The experimental results show that the average surface roughness heights R_a and R_t are low at high cutting speed and comparatively high at low cutting speed. Figure 2 shows the effect of feed on the average surface roughness heights R_a and R_t during turning of Al/SiC-MMC. The experimental results show that surface roughness heights R_a and R_t are low at low feed, i.e. 0.16 mm/rev as compared to the other levels of feed, i.e. 0.32 mm/rev and 0.48 mm/rev. The effect of depth of cut

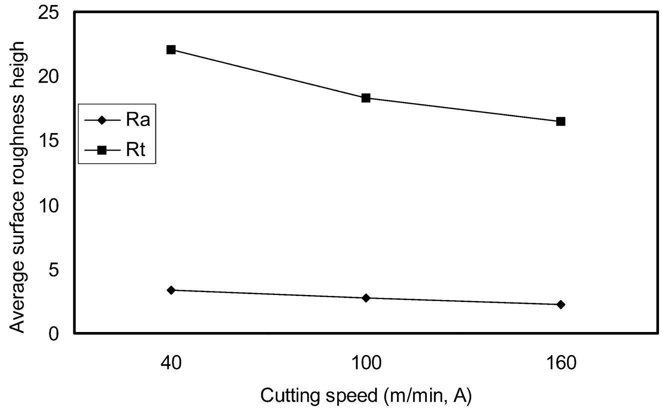

Fig. 1 Effect of cutting speed (m/min, A) on the average surface roughness heights R_a (μm) and R_t (μm)

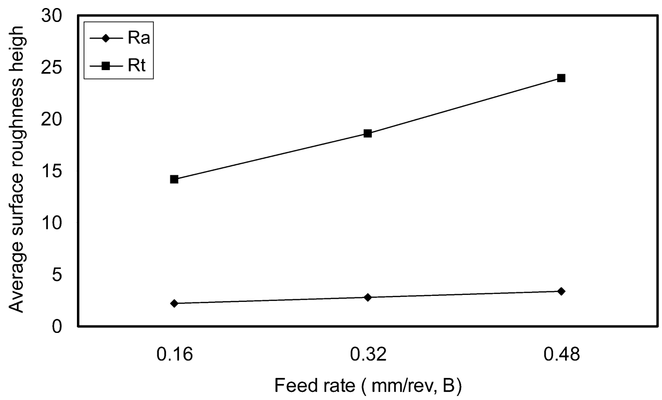

Fig. 2 Effect of feed rate (mm/rev, B) on the average surface roughness heights R_a (μm) and R_t (μm)

Table 10 Confirmation test results for R_a (μm)

Confirmation test number	Surface roughness height R_a (μm)				
	Experimental results	Results as per theoretical model Eq. 3	Error (%)	Results as per developed model Eq. 1	Error (%)
1	1.15	2.50	117.39	1.25	8.69
2	2.28	1.024	55.08	2.51	10.08
3	3.02	0.256	91.59	3.13	3.64

Table 11 Confirmation test results for R_t (μm)

Confirmation test number	Surface roughness peak-to-valley height R_t (μm)				
	Experimental results	Results as per theoretical model Eq. 4	Error (%)	Results as per developed model Eq. 2	Error (%)
1	9.67	78.125	707.91	10.70	10.65
2	16.42	32.00	94.88	17.52	6.70
3	22.63	8.00	64.46	21.26	6.09

on the surface roughness heights R_a and R_t during Al/SiC-MMC turning is shown in Fig. 3. The experimental results show that average surface roughness heights R_a and R_t are low at lower depth of cut, i.e. level 1 and comparatively high at higher depth of cut, i.e. level 3. The three above-mentioned figures show that R_a values remain comparatively less sensitive with respect to R_t values.

Figure 4 shows the influence of cutting speed (A)/ feed (B) interaction on the average surface roughness height R_a during turning of Al/SiC-MMC. The experimental results show that the average surface roughness height R_a is low at high cutting speed, i.e. 160 m/min and at low feed rate, i.e. 0.16 mm/rev. The experimental results also show that the average surface roughness height R_a is high at low cutting speed, i.e. 40 m/min and at high feed, i.e. 0.48 mm/rev. From Fig. 4 it may be concluded that the combination of A_3 B_1 is most significant for producing better surface finish R_a. From the experimental results (Table 6) it can be concluded that the combination of A_3C_1 produces better surface finish R_a as compared to the other combination of AC interaction and that the combination of B_1C_1 produces better surface finish R_a as compared to the other combination of BC interactions. The experimental results also show that the average surface roughness height R_a is low at low feed, i.e. 0.16 mm/rev and low depth of cut, i.e. 0.50 mm.

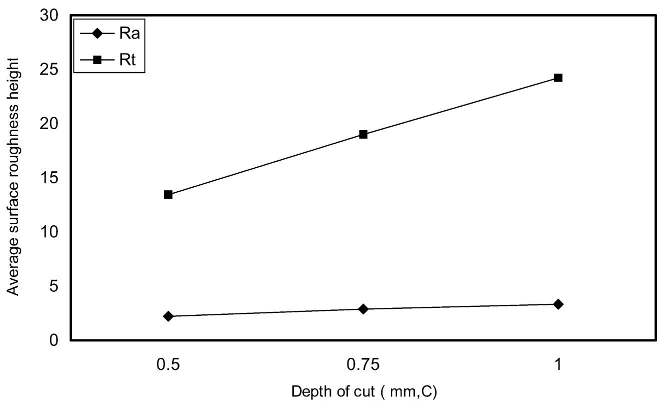

Fig. 3 Effect of depth of cut (mm, C) on the average surface roughness heights R_a (μm) and R_t (μm)

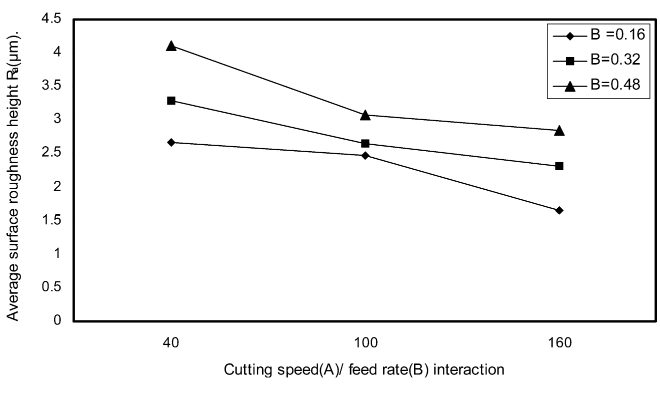

Fig. 4 Effect of cutting speed/feed rate interaction on the average surface roughness height R_a (μm)

Figure 5 shows the influence of cutting speed (A) / feed (B) interaction on the average surface roughness height R_t during turning of Al/SiC-MMC. From Fig. 5, it is observed that the combination of the lowest feed, i.e. level 1 and the highest cutting speed, i.e. level 3 seem most effective for producing better surface finish R_t. From the experimental results (Table 6) it can be concluded that corresponding to the highest cutting speed, i.e. level 3 and the lowest depth of cut, i.e. level 1 shows better surface finish R_t, i.e. the combination of A_3 C_1 produces better surface finish R_t and the combination A_3 B_1 C_1 produces better surface finish during turning of Al/SiC-MMC.

Figure 6 shows the effect of cutting speed (A) on cutting speed (A)/feed (B) two-factor cell total interaction for surface roughness height R_a during turning of Al/SiC-MMC. From Fig. 6, it is observed that at highest cutting speed, i.e. level 3 and at lowest feed, i.e. level 1 produces very low A×B cell total interaction for surface roughness height R_a. From the test results (Table 6) it can be concluded that at high cutting speed, i.e. level 3 and at low depth of cut, i.e. level 1 very low A×C cell total interaction arises for surface roughness height R_a. From the test results, it can also be concluded that at

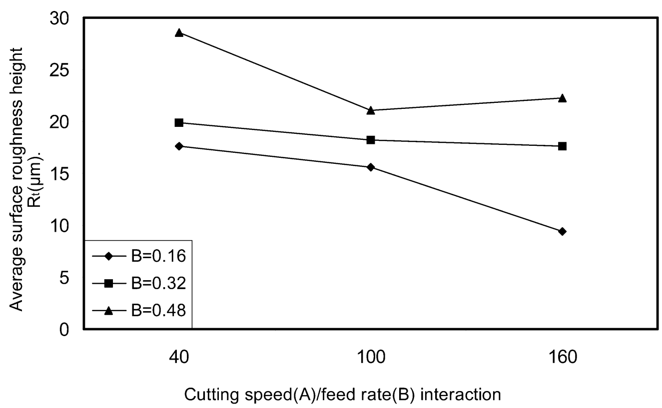

Fig. 5 Effect of cutting speed/feed rate interaction on the average surface roughness height R_t (μm)

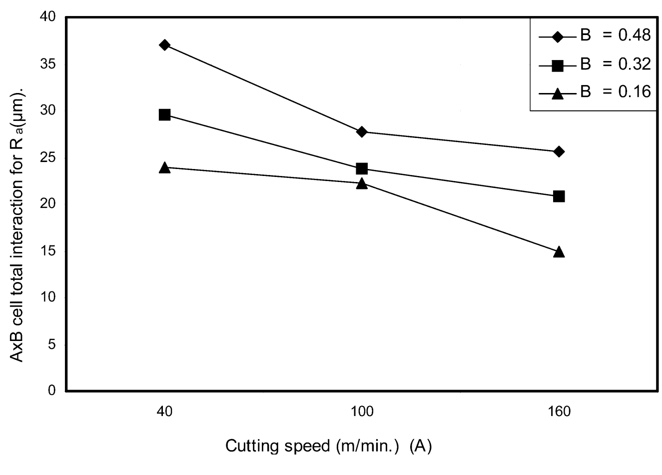

Fig. 6 Cutting speed (A) versus two-factor cutting speed (A) / feed rate (B) cell total interaction for R_a (μm)

low feed, i.e. 0.16 mm/rev and at low depth of cut, i.e. 0.5 mm produces very low B×C cell total interaction for surface roughness height R_a.

Figure 7 shows the effect of cutting speed (A) on cutting speed (A) / feed (B) two-factor cell total interaction for surface roughness height R_t. From Fig 7, it is observed that corresponding to the high cutting speed, i.e. level 3 and low feed, i.e. level 1, there is much less A×B cell total interaction for R_t. The experimental results also show that the combination of high cutting speed, i.e. level 3 and low depth of cut, i.e. level 1 during turning of Al/SiC-MMC produce low A×C cell total interaction for R_t. From the test results (Table 6) it can also be concluded that at low feed, i.e. 0.16 mm/rev and at low depth of cut, i.e. 0.5 mm, very low A×C cell total interaction for R_t results.

Figures 8 and 9 show the effect of cutting speed (factor A) on the influence of surface roughness height R_a and R_t for confirmation of experimental results with developed mathematical models Eq. 1 and Eq. 2 at constant 0.48 mm/rev feed and 1.00 mm depth of cut respectively. From Fig. 8 and Fig. 9 it can be concluded that the developed mathematical models for optimal machining performance, i.e. for surface roughness height R_a and R_t during machining of Al/SiC-MMC agree well with the experimental test results. Figures 10 and 11 show the effect of feed (factor B) on the influence of surface roughness height R_a and R_t for confirmation of experimental results with mathematical models at constant 160 m/min cutting speed and 1.00 mm depth of cut respectively. Figures 12 and 13 show the effect of depth of cut (factor C) on the influence of surface roughness height R_a and R_t for

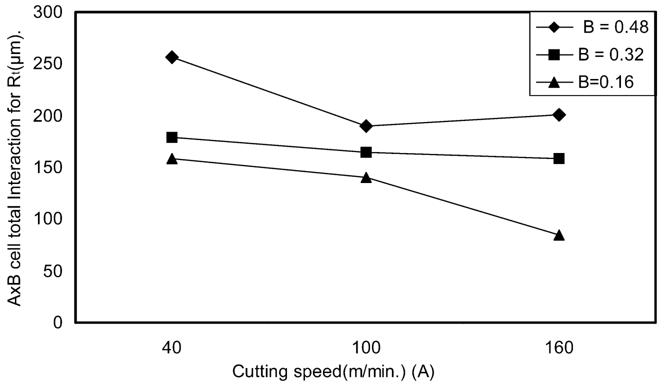

Fig. 7 Cutting speed (A) versus two-factor cutting speed (A) / feed rate (B) cell total interaction for R_t (µm)

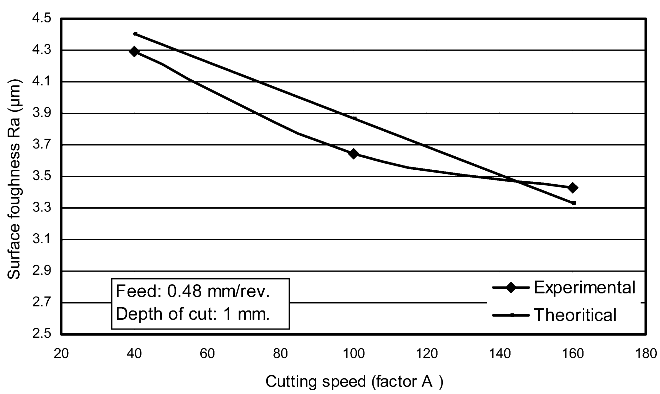

Fig. 8 Confirmation of experimental results with mathematical model for surface roughness R_a (µm)

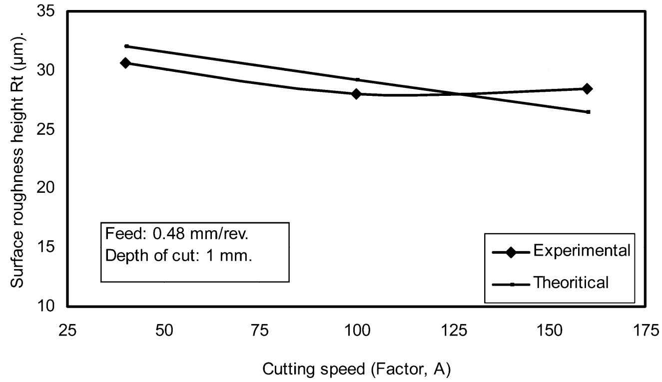

Fig. 9 Confirmation of experimental results with developed mathematical model for R_t (µm)

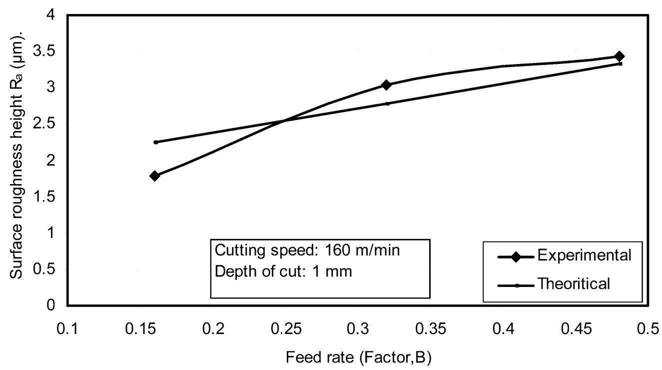

Fig. 10 Confirmation of experimental results with developed mathematical model for R_a (µm)

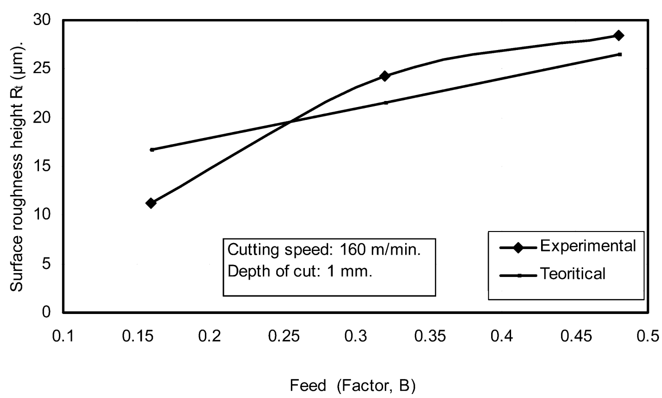

Fig. 11 Confirmation of experimental results with developed mathematical model for R_t (µm)

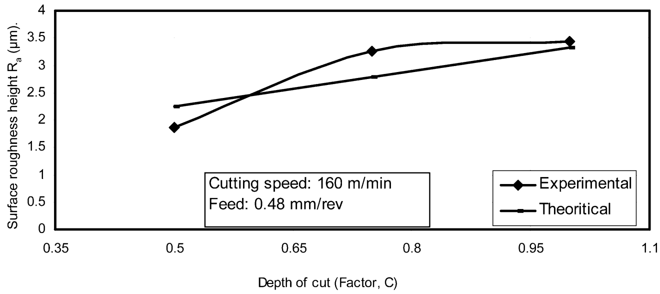

Fig. 12 Confirmation of experimental results with developed mathematical model for R_a (μm)

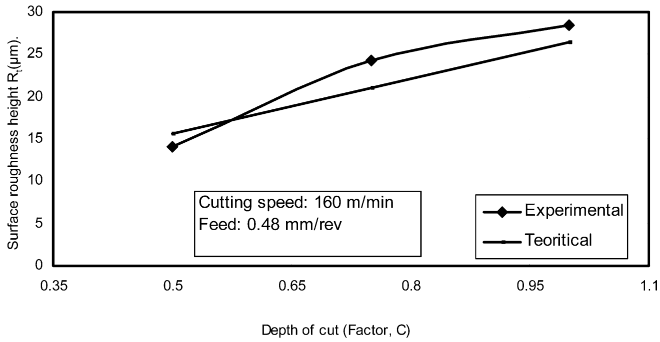

Fig. 13 Confirmation of experimental results with developed mathematical model for R_t (μm)

confirmation of experimental results with mathematical models at constant 160 m/min cutting speed and 0.48 mm/rev feed respectively. From Figures 10, 11, 12 and 13 it can be concluded that the developed mathematical models for optimal surface finish characteristics R_a and R_t during machining of Al/SiC-MMC agree well with the experimental test results.

5 Conclusions

Based on the performance of fixed rhombic tooling and on the basis of experimental results, analysis of ANOVA, "*F*" test values, developed mathematical models and confirmation test results, the following conclusions may be drawn for effective machining of Al/SiC-MMC to achieve better surface finish characteristics during turning:

1. The influence of cutting speed, feed and depth cut is more or less equal on the surface roughness height R_a. The influence of interaction of cutting speed/ feed is also responsible for the arithmetic average roughness height R_a.
2. The depth of cut and feed are most influencing parameters for controlling maximum peak-to-valley roughness height R_t compared to the cutting speed parameter. The interaction of cutting speed/feed, feed/depth of cut and cutting speed/depth of cut has no significant effect on the surface roughness height R_t.
3. The combination of two factor, i.e. A_3 B_1, A_3 C_1 and B_1C_1 produces better surface finish R_a. The combination of high cutting speed, low feed and low depth of cut, i.e. A_3 B_1C_1 is recommended for finish turning.
4. The developed mathematical models for machined surface finish characteristics, i.e. surface roughness heights R_a and R_t are successfully proposed for proper selection of the cutting parameters. Utilising these developed models can aid direct evaluation of R_a and R_t under various machining combinations during turning of Al/SiC-MMC.

Effective machining of Al/SiC metal matrix composite is a challenge to the manufacturing industry and is the main cause for restrictions on widespread application of this advanced MMC in practice. The fixed rhombic tooling of the CCGX-09 T3 04-Al-H10 insert can be effectively used for proper machining of Al/SiC-MMC. A Taguchi-method-based approach for searching out significant cutting parameters to achieve better surface finish during turning of Al/SiC-MMC provides effective guidelines for manufacturing engineers in practice. The above-mentioned research findings also provide an economical machining solution with the utilisation of CCGX-09 T3 04-Al-H10 type uncoated tungsten carbide inserts during processing of Al/SiC-MMC. which are otherwise usually machined using costly PCD and CBN tools.

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