Document details

Procedia Engineering
Volume 184, 2017, Pages 518-528
Advances in Material and Processing Technologies Conference, AMPT 2017; Vellore Institute of TechnologyChennai; India; 11 December 2017 through 14 December 2017

Optimization of Milling Carbon Fibre Reinforced Plastic Using RSM

(Conference Paper)

Khairusshima, M.K.N., Aqella, A.K.N., Sharifah, I.S.S.

International Islamic University Malaysia, Gombak, Selangor, Malaysia

Abstract

View references (12)

Carbon Fibre Reinforced Plastic (CFRP) is extensively used nowadays especially in the industries due to its desirable properties of high strength, light weight and high resistance to corrosion. However, the machining of CFRP composites requires great specification and requirement as it is difficult to be machine. Besides, improper technique and parameters used to machine CFRP may result in poor surface quality such as high surface roughness and delamination. This study was done on a CFRP panel with solid uncoated carbide tool with diameter of 8 mm was used as cutting tool. Thus, this project investigates the influence of the cutting parameters which are spindle speed, feed rate and depth of cut to the surface quality of the CFRP by undergoing milling operation. The cutting parameters used during the milling operation of the CFRP panel ranged from 500 rpm to 3500 rpm for the cutting speed, feed rate from 100 mm/min to 900 mm/min and lastly 0.5 mm to 2.0 mm range for depth of cut. 15 runs of experiments is performed based on the Central Composite Design (CCD) of Response Surface Methodology. Through this study, the optimum cutting parameters during milling of CFRP is determined and the main factors affecting the surface quality are also highlighted. Based on the developed mathematical model, the feed rate was identified as the primary significant parameter that influenced surface roughness and delamination. In conclusion, the influence of the cutting parameters on the CFRP panel is higher cutting speed, lower feed rate and lower depth of cut resulted in low surface roughness and delamination factor. Feed rate was identified to be the primary significant cutting parameter that contributes to low surface roughness and delamination factor. The optimized cutting parameters were cutting speed, feed rate and depth of cut of 3061 rpm, 211.34 mm/min and 0.72 mm respectively with surface roughness of 1.34 um and delamination factor of 1.08. © 2017 Published by Elsevier Ltd.

Reaxys Database Information

View Compounds

Author keywords

CFRP | Delamination factor | Optimization | solid carbide | Surface Roughness

Indexed keywords

Engineering controlled terms: Carbon fiber reinforced plastics | Carbon fibers | Cutting | Cutting tools | Delamination | Fiber reinforced plastics | Milling (machining) | Optimization | Reinforced plastics | Reinforcement | Surface properties | Turning

Related documents

Prediction of surface roughness in abrasive water jet machining of CFRP composites using regression analysis

Kumaran, S.T. , Ko, T.J. , Uthayakumar, M.
(2017) Journal of Alloys and Compounds

Optimisation of process parameters for the orbital and conventional drilling of uni-directional carbon fibre-reinforced polymers (UD-CFRP)

Geier, N. , Szalay, T.
(2017) Measurement: Journal of the International Measurement Confederation

High resolution radio frequency inspection of carbon fiber composites

Heuer, H. , Schulze, M. , Pooch, M.
(2016) 2016 21st International Conference on Microwave, Radar and Wireless Communications, MIKON 2016

Compendex keywords: Carbon fibre reinforced plastic (CFRP) Central composite designs CFRP composites Cutting parameters Delamination factor Low surface roughness Milling operation Response surface methodology

Engineering main heading: Surface roughness

ISSN: 18777058
Source Type: Conference Proceeding
Original language: English
DOI: 10.1016/j.proeng.2017.04.122
Document Type: Conference Paper
Sponsors:
Publisher: Elsevier Ltd

References (12)

1 Xu, J., El Mansori, M.
Experimental study on drilling mechanisms and strategies of hybrid CFRP/Ti stacks
(2016) *Composite Structures*, 157, pp. 461-482. Cited 2 times.
www.elsevier.com/inca/publications/store/4/0/5/9/2/8
doi: 10.1016/j.compstruct.2016.07.025
View at Publisher

2 Karpat, Y., Bahtiyar, O., Deger, B.
Milling force modelling of multidirectional carbon fiber reinforced polymer laminates
(2012) *Procedia CIRP*, 1 (1), pp. 460-465. Cited 11 times.
http://www.sciencedirect.com/science/journal/22128271
doi: 10.1016/j.procir.2012.04.082
View at Publisher

3 Grilo, T.J., Paulo, R.M.F., Silva, C.R.M., Davim, J.P.
Experimental delamination analyses of CFRPs using different drill geometries
(2013) *Composites Part B: Engineering*, 45 (1), pp. 1344-1350. Cited 50 times.
doi: 10.1016/j.compositesb.2012.07.057
View at Publisher

4 Cong, W.L., Pei, Z.J., Treadwell, C.
Preliminary study on rotary ultrasonic machining of CFRP/Ti stacks
(2014) *Ultrasonics*, 54 (6), pp. 1594-1602. Cited 14 times.
http://www.elsevier.com/wps/find/journaldescription.cws_home/525452/description#description
doi: 10.1016/j.ultras.2014.03.012
View at Publisher

5 Heuer, H., Schulze, M., Pooch, M., Gäbler, S., Nocke, A., Bardl, G., Cherif, C., (...), Petrenz, S.
Review on quality assurance along the CFRP value chain - Non-destructive testing of fabrics, preforms and CFRP by HF radio wave techniques
(2015) *Composites Part B: Engineering*, 77, pp. 494-501. Cited 33 times.
doi: 10.1016/j.compositesb.2015.03.022
View at Publisher

6 Slamani, M., Gauthier, S., Chatelain, J.-F.

Comparison of surface roughness quality obtained by high speed CNC trimming and high speed robotic trimming for CFRP laminate

(2016) *Robotics and Computer-Integrated Manufacturing*, 42, pp. 63-72. Cited 3 times.
doi: 10.1016/j.rcim.2016.05.004

View at Publisher

7 Abhishek, K., Datta, S., Mahapatra, S.S.

Multi-objective optimization in drilling of CFRP (polyester) composites: Application of a fuzzy embedded harmony search (HS) algorithm

(2016) *Measurement: Journal of the International Measurement Confederation*, 77, pp. 222-239. Cited 11 times.
doi: 10.1016/j.measurement.2015.09.015

View at Publisher

8 Rajasekaran, T., Palanikumar, K., Vinayagam, B.K.

Turning CFRP composites with ceramic tool for surface roughness analysis

(2012) *Procedia Engineering*, 38, pp. 2922-2929. Cited 7 times.
http://www.sciencedirect.com/science/journal/18777058
doi: 10.1016/j.proeng.2012.06.341

View at Publisher

9 Eneyew, E.D., Ramulu, M.

Experimental study of surface quality and damage when drilling unidirectional CFRP composites

(2014) *Journal of Materials Research and Technology*, 3 (4), pp. 354-362. Cited 20 times.
http://www.elsevier.com/journals/journal-of-materials-research-and-technology/2238-7854
doi: 10.1016/j.jmrt.2014.10.003

View at Publisher

10 Noordin, M.Y., Venkatesh, V.C., Sharif, S., Elting, S., Abdullah, A.

Application of response surface methodology in describing the performance of coated carbide tools when turning AISI 1045 steel

(2004) *Journal of Materials Processing Technology*, 145 (1), pp. 46-58. Cited 328 times.
doi: 10.1016/S0924-0136(03)00861-6

View at Publisher

11 Palanikumar, K., Davim, J.P.

Assessment of some factors influencing tool wear on the machining of glass fibre-reinforced plastics by coated cemented carbide tools

(2009) *Journal of Materials Processing Technology*, 209 (1), pp. 511-519. Cited 49 times.
doi: 10.1016/j.jmatprotec.2008.02.020

View at Publisher

12 Tsao, C.C., Hocheng, H.

Taguchi analysis of delamination associated with various drill bits in drilling of composite material

(2004) *International Journal of Machine Tools and Manufacture*, 44 (10), pp. 1085-1090. Cited 193 times.
doi: 10.1016/j.ijmachtools.2004.02.019

View at Publisher

Khairusshima, M.K.N.; International Islamic University Malaysia, Gombak, Selangor, Malaysia;
email:norkhairusshima@iium.edu.my