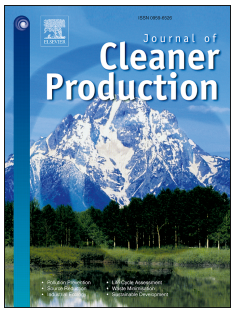
Accepted Manuscript



Selection of optimum parameters in multi-pass face milling for maximum energy efficiency and minimum production cost

Congbo Li, Xingzheng Chen, Ying Tang, Li Li

PII: S0959-6526(16)30982-9

DOI: 10.1016/j.jclepro.2016.07.086

Reference: JCLP 7658

To appear in: *Journal of Cleaner Production*

Received Date: 28 July 2015

Revised Date: 22 January 2016

Accepted Date: 15 July 2016

Please cite this article as: Li C, Chen X, Tang Y, Li L, Selection of optimum parameters in multi-pass face milling for maximum energy efficiency and minimum production cost, *Journal of Cleaner Production* (2016), doi: 10.1016/j.jclepro.2016.07.086.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Selection of Optimum Parameters in Multi-pass Face Milling for Maximum Energy Efficiency and Minimum Production Cost

Congbo Li[1*], Xingzheng Chen[1], Ying Tang[2], Li Li[3]

[1]*State Key Laboratory of Mechanical Transmission, Chongqing University, Chongqing, P.R. China*

[2]*Department of Electrical and Computer Engineering, Rowan University, Glassboro, New Jersey, USA*

[3]*College of Engineering and Technology, Southwest University, Chongqing, P.R. China*

Abstract: In a multi-pass face milling process, cutting parameters for each pass and the total number of passes dramatically affect the electrical energy consumption and production cost of the final product. In this paper, the electrical energy consumption characteristics of multi-pass face milling are firstly analyzed. Then a multi-objective parameter optimization model for maximizing energy efficiency and minimizing production cost is proposed and solved by the Adaptive Multi-objective Particle Swarm Optimization algorithm. Finally, a case study is carried out to validate the proposed model and search for the trade-off solutions between maximum energy efficiency and minimum production cost. From the results of the case study, significant interaction effects between cutting parameters and number of passes are revealed. Moreover, it also can be found that the traditional multi-pass parameter optimization for minimizing production cost does not necessarily satisfy the maximum energy efficiency criterion. Simultaneously optimizing the cutting parameters of each pass and the total number of passes achieves a trade-off between maximum energy efficiency and minimum production cost. Based on the work presented in this paper, manufacturers can easily improve energy efficiency and reduce production cost in the multi-pass face milling process.

Keywords: Energy efficiency; Multi-pass; Face milling; Parameter optimization

1. Introduction

In modern manufacturing, the need to reduce energy consumption becomes one of the most relevant challenges due to the global energy crisis and climate changes. Research has found out that although machine tools account for a significant portion of industry sector's electrical energy consumption, their energy efficiency is quite low. As reported by Gutowski et al. (2006), for a milling machine tool, only 14.8% of its total energy consumption is used for actual machining. Therefore, improving energy efficiency and reducing energy consumption of machine tools have attracted more and more attention from academy and industry practitioners.

Many researchers have studied the relationship between cutting parameters and energy consumption of a single pass machining. Negrete (2013) presented an experimental study using Taguchi method and ANOVA to evaluate the effect of cutting parameters on energy consumption. They found that the minimum energy consumption could be achieved through higher feed rate, lower cutting depth and cutting velocity. The same methods were utilized by Emami et al. (2014) to investigate the performance of four types of lubricants, namely mineral, hydrocracker, synthetic, and vegetable oils, with regard to the reduction of cutting force, specific energy and surface roughness in grinding of Al2O3 engineering ceramic. Simoneau and Meehan (2013) studied the impact of cutting parameters on

* Corresponding author. Tel.: +86 23 65103159; Fax: +86 23 65105098.

E-mail address :congboli@cqu.edu.cn

Download English Version:

https://daneshyari.com/en/article/5481436

Download Persian Version:

https://daneshyari.com/article/5481436

Daneshyari.com