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Development of Innovative Tool Using Taguchi-methods

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Abstract

The software for innovative tool using Taguchi-methods is developed and evaluated. There are two trials in the innovative tool using Taguchi-methods; First trial is accomplished for selecting important control factors and its optimum region, and Second trial decides the optimum combination of the control factors by more detail trial using only important control factors. The optimum condition regarding cooling system for cutting was investigated for evaluating this innovation tool in the experiment. It is concluded from the result that (1) Innovative tool using the Taguchi-methods was useful for development with short-term and lower cost, and (2) This tool could quickly and exactly decide the optimum cooling condition.

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Keywords: Taguchi-methods, innovation, oputimum condition

1. Introduction

Recently developments with short-term and lower cost are strongly required for shorten products life cycle. Therefore Taguchi-methods [1],[2] are used for deciding optimum process conditions. However these methods are not enough to develop a new product with short time, lower cost, high quality and high accuracy.

In this research, the software for innovative tool using Taguchi-methods is developed and evaluated. There are two trials in the innovative tool using Taguchi-methods. First trial investigates rough fuctions regarding all

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levers of all control factors, then important control factors and meaningless control factors were sorted with the several comments for the second trial. At that time, maximum, intermediate and minimum values for each lever of the each control factor should used for pursuit of all possibilities. Second trial decides the optimum combination of the control factors by more detail trial using only important control factors. The second trial is tried for getting the best combination using the optimum level of each control factor. The optimum condition regarding cooling system for cutting was investigated for evaluating this innovation tool in the experiment.

2. Explanation of Taguchi-methods

The Taguchi-methods is used to decide optimum processing conditions with narrow dispersion for robust design. Therefore the Taguchi-methods is explained in this section.

Control factors are equal to the design factors (See the control factors in Table 1). Noise factors are occurred for the error of function on the product (See the noise factors in Table1). Most designer can understand that the final functions of the developed product are strongly influenced for the each lever of each control factor under several noise factors. All combinations using all control factors are compressed by an orthogonal table (See the orthogonal array in Table 2).Then the experiment or the CAE analysis with influence of noise factors is performed by the orthogonal array. At last, the average and the standard deviation regarding all combinations using all control factors are calculated for the SN ratio and Sensitivity. Then most of users write the effective figure (Fig. 1) of the control factors and zealously search the combination of the control factors for large SN ratio. A product using the combination isn't nearly influenced by noise factors.

Table 1. Control and noise factors in Taguchi-methods.

Control factors				
Name	A	B	C	D
Levels	A_1	B_1	C_1	D_1
	A_2	B_2	C_2	D_2
	A_3	B_3	C_3	D_3
Noise factors				
Name	N			
Levels	N_1	N_2	N_3	

Table 2. Orthogonal array, SN ratio and sensitivity in the Taguchi-methods

Trial No.	Control factors				Result with noise factors			SN ratio (db)	Sensitivity (db)
	A	B	C	D	N_1	N_2	N_3		
1	A_1	B_1	C_1	D_1	2.7	2.6	2.4	24.5	8.2
2	A_1	B_2	C_2	D_2	2.3	2.2	2.0	23.0	6.7
3	A_1	B_3	C_3	D_3	2.1	1.9	2.0	26.0	6.0
4	A_2	B_1	C_2	D_3	3.3	3.1	3.0	26.2	9.9
5	A_2	B_2	C_3	D_1	4.6	4.4	4.5	33.1	13.1
6	A_2	B_3	C_1	D_2	3.3	3.3	3.0	25.3	10.1