An Implementation of the Variance Analysis (ANOVA) for Mattresses Factory at Fisher Pairwise Comparisons Level

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Abstract

Mattresses factory has four factors which been selected according to the High-speed automatic mattress quilting Sewing machine (WBSH-3). We implement variables of the growth of the textile in four groups (A, B, C, and D) and each has two-level on the Mattresses sector. However, from the data set, we have two categorical variables with Mattresses (Needle Gauge, Quilting Thickness/ Width, Speed, and Stitch Length) and there is four-level of Mattresses, also we do have Sewing Machine Factory which is for level two W, X, Y, and Z. The response is (Y) and the factor is the absolute variable is Mattresses. This means they are all equal which is the Needle Gauge means of Quilting Thickness/ Width mean of Speed mean of Stitch Length, they are equal the alternative hypothesis is that one is different. We analyze the variance of the P-Value we used to sort of the interpret that is the null hypothesis or in our alternative hypothesis earlier on it is (0.000) which means are all equal and it rejects the null data.

Keywords
ANOVA, DOE, Mattresses

Introduction

A tremendous amount of research has been done to understand the mechanics associated with machining processes. Besides empirical or analytical methods, the advent of computers has allowed researchers to study machining through sophisticated numerical techniques. These include finite element modeling, molecular dynamics studies and recently multi-scale modeling. Despite the success in modeling 2-D and 3-D machining, there are still many challenges associated with modeling of machining processes. This section provides a quick review of each modeling technique.

Finite Element Modeling (FEM) Formulations and Approaches
This method has been the most popular method in machining simulation as chip geometry does not have to be predefined but rather develops as the cutting progresses, albeit it is dependent on a defined chip separation criterion. In FEM, three main formulations have been proposed for machining simulations: Eulerian, Lagrangian, and Arbitrary Lagrangian-Eulerian (ALE) methods.

Constitutive Materials Modeling
Under machining conditions, generally, the workpiece is subjected to extreme deformation involving high levels of strain and strain rate and rapid temperature rise. The Norton–Hoff material model was applied by Monaghan and Brazil to model the machining of a particulate reinforced Metal matrix composites (MMC), while the J–C model has

been successfully applied to the modeling of a silicon carbide particle reinforced aluminum matrix composite. The important aspect in applying this model is the relevance of the experimental data as it needs to cover material deformation under a range of strains, strain rates and temperatures typically seen in machining and hence it usually requires obtaining data from a number of resources.

Chip-separation criteria
In finite element modeling simulations, the variables that control fracture are the current variables of stress and strain tensors and their histories. Some of the damage criteria used today, either built-in in commercial FEA codes or through the implementation of user-defined subroutines for machining simulations, are:-

- Constant equivalent strain criterion.
- Maximum shear stress criterion.
- Johnson–Cook fracture model.
- Cockroft–Latham criterion.

Friction at the tool–chip interface.
Filice et al. analyzed the influence of different friction models on the results of numerical machining simulations. They concluded that for the studied workpiece/tool combination, most mechanical results are not influenced by the friction model except for the temperature at the tool chip interface. Friction at the tool is another parameter important to the accuracy of numerical machining simulations is the friction at the tool–chip interface.

Molecular dynamics simulations
Molecular dynamics simulations have been mainly applied to nanometric cutting since the depth of cut is of the nanometer range. Maekawa and Itoh concluded that the influence of friction on tool wear in nanometric cutting is very similar to that observed in macroscale machining. Zhang and Tanaka identified four distinct wear regions at the tool chip interface: regions of no-wear, adhering, plowing wear and cutting regions. Molecular dynamics simulations allow the user to study many atomic-scale physical phenomena, the drawbacks are that it is valid only for nanometric cutting and furthermore the cutting speeds associated.

Multi-scale modeling
A number of methods have been proposed to reduce the computational cost for carrying out multimillion atom simulations necessary to simulate micromachining using only molecular dynamics simulations. Ogata et al. proposed a hybrid FE-MD simulation model to couple the two length scales, henceforth referred to as the quasi-continuum (QC) method.

The model was successful in predicting the chip morphology, cutting forces and residual stresses after machining. Md Masud Rana, Li Li, and Steven W. Su. their paper proposes a recursive systematic convolutional (RSC) code and Kalman filter (KF) based method in the context of smart grids so that the power system can operate properly test results show that the proposed approach can accurately mitigate the cyber attacks and properly estimate and control the system states.

the extended Kalman filter (EKF) technique for dynamic state estimation of a synchronous machine using phasor measurement unit (PMU) quantities are developed. Recharsh by Ghahremani, Esmaeil, and Innocent Kamwa, conditions, compared to the classic EKF approach and confirm its great potential in cases where there is no access to the input signals of the system. Due to the intermittent property, the wind power generation patterns vary, which may risk distribution network operations. Md Masud RanaLi, LiLi, and Steven Weidong Suv, there study it is intrinsically necessary to monitor wind turbines in a distributed way. This paper presents an adaptive-then- combine a distributed dynamic approach for monitoring the grid under lossy communication links between the wind turbines and energy management system. In 2002 study approached with a computation algorithm using the exponential function to increase the robustness of the dynamic state estimation is proposed. Kuang-Rong Shih and Shyh-Jier Huang did their methodology lie in its immunity to the polluted measurements, while the implementation of the method is not complicated when compared with other methods.

Analysis & Results

Four factors were selected according to the WBSH-3 High-Speed Automatic Mattress Quilting Sewing Machine Factory. Table 1 shows the variables that implement the growth of the textile in the Mattresses sector.

Table 1. The variables implement the growth of the textile on Mattresses sector

Group	#	Factors	Level 1	Level 2
A	1	Needle Gauge	12.7mm	25.4mm
B	2	Quilting Thickness/ Width	≤25MM (Depend on material density) / 406mm	≤40MM (Depend on material density) / 500mm
C	3	Speed	1000RPM	1200RPM
D	4	Stitch Length	2	7

By looking to data set, we have a response variable (Y) and we have two categorical variables with its Mattresses (Needle Gauge, Quilting Thickness/ Width, Speed, and Stitch Length) and there is four leave of Mattresses, also we do have Sewing Machine Factory which is for level two W, X, Y, and Z. we will concentrate on Mattresses and essentially what we are going to do here is just comprehend is the mean of (Y) if different between each Mattresses. By using One-way ANOVA. Table 2.

Table 2. Two categorical variables & four leave of Mattresses

Null hypothesis	All means are equal
Alternative hypothesis	Not all means are equal
Significance level	$\alpha = 0.05$

Yame, A, etc. The response is (Y) and the factor is the categorical variable is Mattresses. All means are equal, which is mean the mean of Needle Gauge means of Quilting Thickness/ Width mean of Speed mean of Stitch Length, they are equal to the alternative hypothesis is that one is different. So we have four Mattresses and sample from four Mattresses in the sense you want to do is infer that the general equal variance is assumed for the analysis, the factor is Mattresses and there are four levels. Figure 1 showing a Box plot of Y for The variables in Mattresses sector

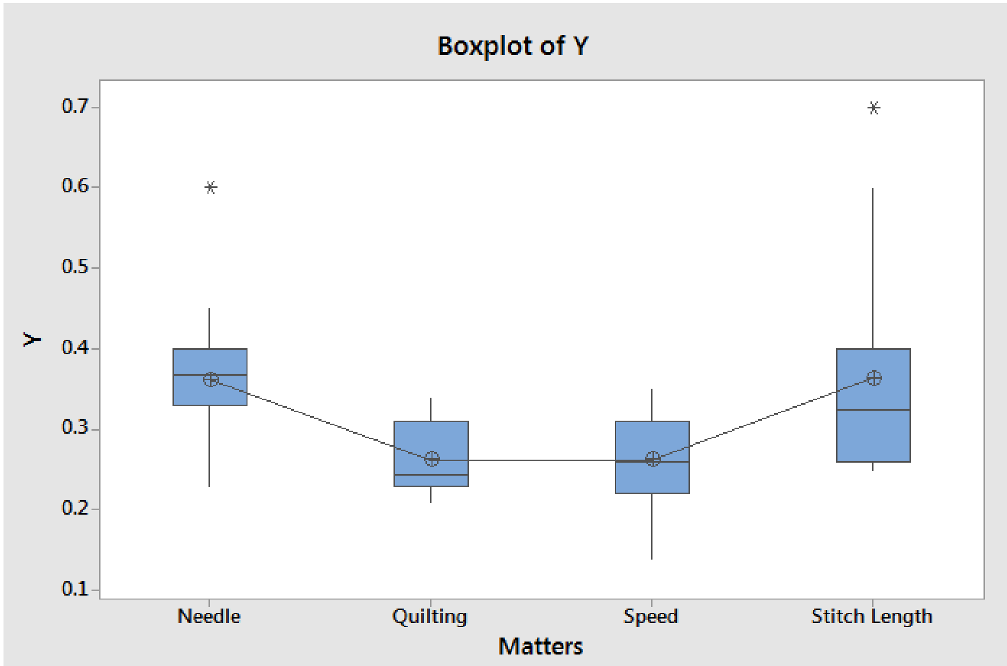

Figure 1. Box plot of Y

Analysis of Variance

This is the p-Value we used to sort of interpreting that null hypothesis or in our alternative hypothesis earlier on, it's (0.000) its means we reject the null hypothesis, which is mean are equal. Table 3.

Table 3. Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Mattresses	3	0.2419	0.080624	11.27	0.000
Error	92	0.6584	0.007157		
Total	95	0.9003			

Model Summary

For the summary statistics for each of the four groups A, B, C, and D, so it seems just 24 is in each sample A, B, C are quite to know that the low 80s, but we notice the A is in the high 80s. Table 4.

S	R-sq	R-sq(adj)	R-sq(pred)
0.0845977	26.87%	24.48%	20.37%

R-squared value (= 26.87%) is very small.

Table 4. Summary statistics for each of the four groups

Mattresses	N	Mean	StDev	95% CI
Needle	24	0.3619	0.0793	(0.3276, 0.3962)
Quilting	24	0.26275	0.04290	(0.22845, 0.29705)
Speed	24	0.2627	0.0589	(0.2285, 0.2970)
Stitch Length	24	0.3643	0.1305	(0.3300, 0.3986)

Pooled StDev = 0.0845977

The confidence interval for the means, essentially what was in A (Needle) has much higher content, by comparison, our sponsor or develop that mean v- values are much higher in general one compared to A, B, C, and D. so the A is the one that sort of sticks out, and it's different from the rest.

Tukey Pairwise Comparisons

Which one is significantly different from each other, essentially D out in its own, D it's not like any of the other's, but A, B, and C are not significantly Table 5 Grouping Information Using the Tukey Method, and 6 Tukey Simultaneous Tests for Differences of Means

Table 5. Grouping Information Using the Tukey Method and 95% Confidence

Mattresses	N	Mean	Grouping	
Stitch Length	24	0.3643	A	
Needle	24	0.3619		A
Quilting	24	0.26275		B
Speed	24	0.2627		B

Means that do not share a letter are significantly different.

Table 6. Tukey Simultaneous Tests for Differences of Means

Difference of Levels	Difference of Means	SE of Difference	95% CI	T-Value	Adjusted P-Value
Quilting - Needle	-0.0992	0.0244	(-0.1631, -0.0353)	-4.06	0.001
Speed - Needle	-0.0992	0.0244	(-0.1631, -0.0353)	-4.06	0.001
Stitch Lengt - Needle	0.0024	0.0244	(-0.0615, 0.0663)	0.10	1.000
Speed - Quilting	-0.0000	0.0244	(-0.0639, 0.0639)	-0.00	1.000
Stitch Lengt - Quilting	0.1016	0.0244	(0.0377, 0.1655)	4.16	0.000
Stitch Lengt - Speed	0.1016	0.0244	(0.0377, 0.1655)	4.16	0.000

Individual confidence level = 98.96%

Tukey Simultaneous 95% CIs Figure 2
Fisher Pairwise Comparisons

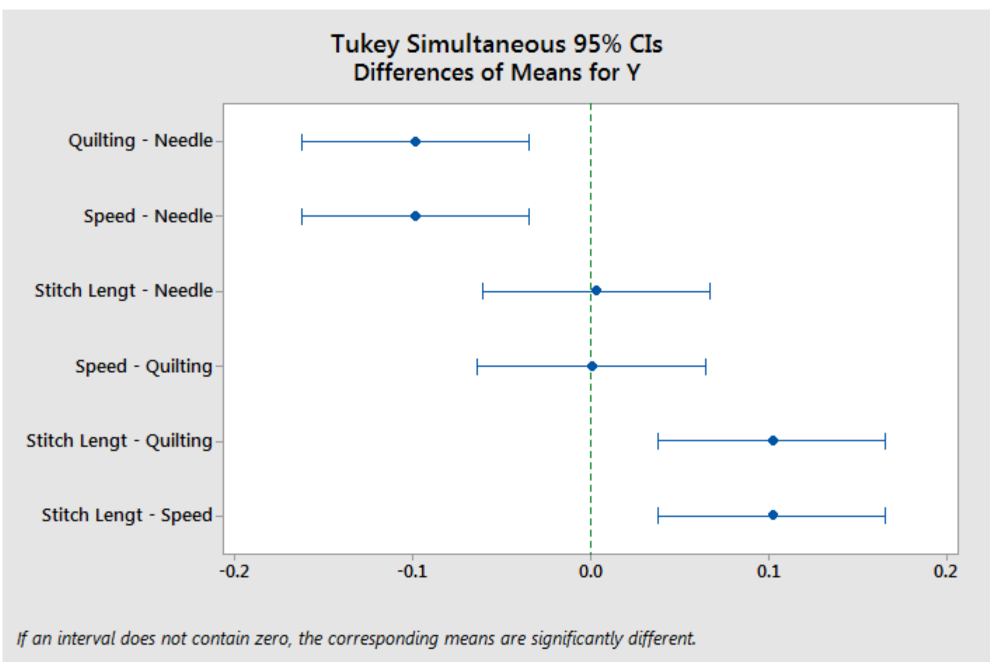

Figure 2. Tukey Simultaneous 95% CIs difference of means for Y

Table 7. Grouping Information Using the Fisher LSD Method and 95% Confidence

Mattresses	N	Mean	Grouping	
Stitch Length	24	0.3643	A	
Needle	24	0.3619	A	
Quilting	24	0.26275		B
Speed	24	0.2627		B

Means that do not share a letter are significantly different. Table 7.

Simultaneous confidence level = 79.93%

Fisher Individual 95% CIs
Interval Plot of Y vs Mattresses. Figure 3. Interval Plot of Y vs Mattresses 95% CI for the Mean. Figure 4. Fisher Individual 95% CIs differences of Means for Y

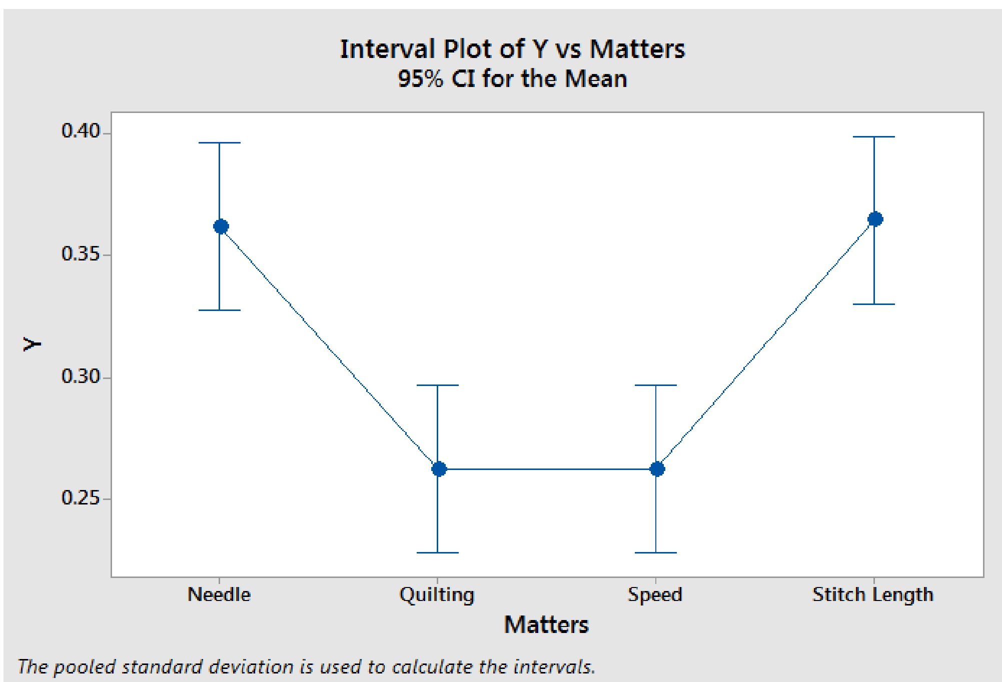

Figure 3. Interval Plot of Y vs Mattresses 95% CI for the Mean

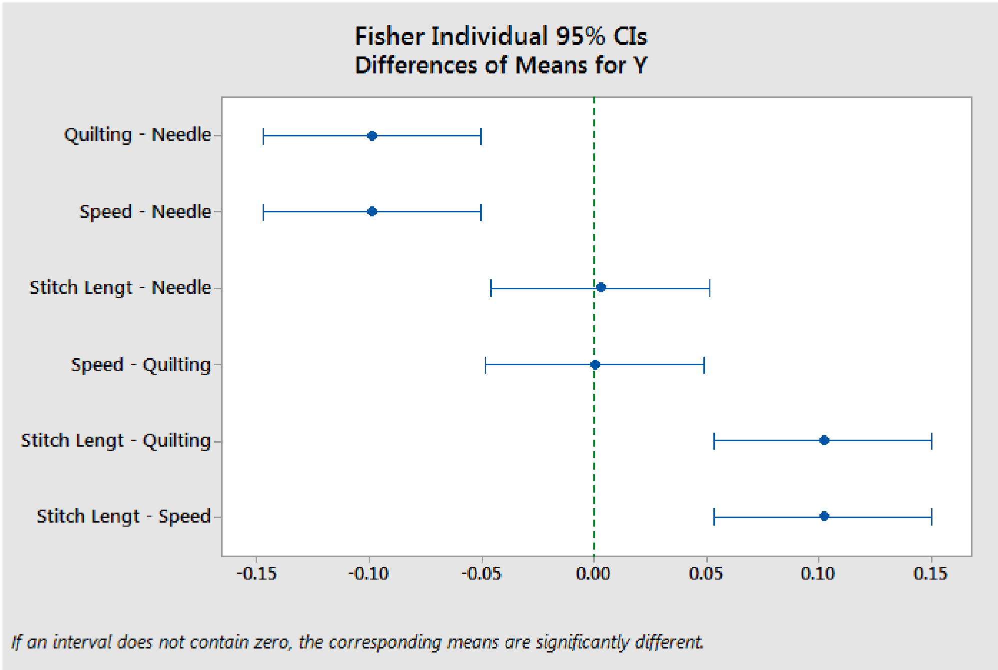

Figure 4. Fisher Individual 95% CIs differences of Means for Y

Conclusion

We implemented variables of the growth of the textile in four groups (A, B, C, and D). The response is (Y) and the factor is the absolute variable is Mattresses. This means they are all equal which is the Needle Gauge means of Quilting Thickness/ Width mean of Speed mean of Stitch Length, they are equal the alternative hypothesis is that one is different. We analyze the variance of the P-Value The null hypothesis is rejected if the P-value is less than the significance level. The response is clearly defined and its type should be mentioned. is it "Larger the better". we used to sort of the interpret that is the null hypothesis or in our alternative hypothesis earlier on it is (0.000) which means are all equal and it rejects the null data.R-squared value (= 26.87%) is very small.

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Biography

Dr. Ahmad Yame earned his Bachelor degree in Engineering Technology from the Lawrence Technological University in 2010, Mr. Yame has three master degree, the latest was in 2015 in Industrial Engineering from Lawrence Technological University, second MSc was in Engineering Management 2011 from the Lawrence Technological University and his first MSc was in Mechanical Engineering back in 2007 from the National University of Malaysia. He earned his Associate's degree in Mechanical Engineering 2004 from the Libyan Higher Professional Center for Comprehensive Professions. He primarily develops engineers but also has experience with software and testing. Dr.Yame has tested many enterprise applications for automotive MAHLE Laboratories in 2013, he working with Panasonic automotive in North America since 2016 to test vehicles for AHU/Sync and diagnostic functionalities of engine control systems. He has organized several simulations, in order to test the engine control software and the diagnostic functionality on a CANlog, respectively, through non-regression and diagnostic tests.