IEEE

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International Conference on Information and Communications Technology

Yogyakarta, Indonesia | 24-25 July 2019

Venue: Grand Inna Malioboro Hotel

UPDATE INFORMATION

Venue Conference: Grand Inna Malioboro Hotel

General Schedule 2nd ICOIACT 2019: Click Here

CALL FOR PAPER

The emergence of Technology as a ubiquitous platform for innovations has laid the foundation for the rapid growth of the Information. The 2nd International Conference on Information and Communications Technology 2019 (2nd ICOIACT 2019) will be held on 24 – 25 July 2019 in Grand Inna Malioboro Hotel, Yogyakarta, Indonesia.

The purpose of the ICOIACT 2019 is to promote discussion and interaction among academics, researchers and professionals in the field of Technologies and Information Engineering.

This conference provides an international forum for the presentation and showcase of recent advances on various aspects of ubiquitous technology. It will reflect the state-of-the-art of the methods, involving theory, algorithm, numerical simulation, error and uncertainty analysis and/or novel application of new processing techniques in engineering, science, and other disciplines related to ubiquitous computing. In this conference, several topics on the specific themes for intensive discussions are also planned according to the areas of interest. ICOIACT 2019 will include presentations of contributed papers.

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Visual Information Retrieval: From low-level machine vision to deep-learning and beyond

Prof. Abdul Wahab Bin Abdul Rahman

Senior at FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY, International Islamic University Malaysia

Predictive Behavior in Neuro Physiological Interaction of Affect

Hanung Adi Nugroho, S.T., M. E., Ph.D

Secretary of Electrical and Information Engineering Department, Universitas Gadjah Mada, Indonesia

Towards Development of An Intelligent System for Plasmodium Parasite Detection

SCOPE

"INTELLIGENT SYSTEMS FOR CREATIVE INDUSTRY 4.0 IN DISRUPTION ERA"

On behalf of the committee, we proudly announce you that Universitas AMIKOM Yogyakarta is going to organize International Conference on Information and Communications Technology (ICOIACT) which will take place from 24 -25 July 2019 in Grand Inna Malioboro Hotel, Yogyakarta, Indonesia.

The conference is organized by Universitas AMIKOM Yogyakarta and the technical co-sponsored by IEEE Student Branch, Universitas AMIKOM Yogyakarta, Indonesia. The theme of this year's ICOIACT is "Intelligent Systems for Creative Industry 4.0 in Disruption Era". The conference will strengthen the collaboration and provide a forum for academicians, professionals and researchers to discuss and exchange their research results, innovative ideas, and experiences to advance the field of Information Technology, Information Systems and Electronic Engineering in the industrialized world.

We all the committee would like to say welcome, and we hope this conference will give you a valuable experience and a memorable stay in Yogyakarta, Indonesia. We respectfully invite you to submit your latest research paper to ICOIACT 2019.

Topics Of Interest Include (But Are Not Limited To):

TRACK 1
Communication, Networking, and Broadcasting

- Communication Systems and Communication Standards
- Sensor Networks
- Acoustic and Under Water Communication
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- RFIDs and Applications
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- Information Security and Network Security
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- Telecommunication and Mobile Communication

TRACK 2
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- Data Mining, Web Technology and Ontology
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TRACK 3
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- IT and Management
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Time	BARON Room	PARANGKUSUMA Room	PARANGTRITIS Room	SAMAS Room
Wednesday, July 24				
07:00 am-07:30 am	REGISTRATION at NAKULA Room			
07:30 am-08:30 am	1: Parallel Session 1-A	1B: Parallel Session 1-B	1C: Parallel Session 1-C	1D: Parallel Session 1-D
08:30 am-09:00 am	Snack + Coffee Break			
09:00 am-12:00 pm	Opening Ceremony + Plenary Speakers			
12:00 pm-01:00 pm	Lunch Break			
01:00 pm-03:00 pm	2A: Parallel Session 2-A	2B: Parallel Session 2-B	2C: Parallel Session 2-C	2D: Parallel Session 2-D
03:00 pm-03:30 pm	Snack + Coffee Break			
03:30 pm-05:30 pm	3A: Parallel Session 3-A	3B: Parallel Session 3-B	3C: Parallel Session 3-C	3D: Parallel Session 3-D
05:30 pm-05:32 pm	End of Session 1st Day			
Thursday, July 25				
07:00 am-07:30 am	REGISTRATION at NAKULA Room			
07:30 am-09:30 am	4A: Parallel Session 4-A	4B: Parallel Session 4-B	4C: Parallel Session 4-C	4D: Parallel Session 4-D
09:30 am-10:00 am	Snack + Coffee Break			
10:00 am-12:00 pm	5A: Parallel Session 5-A	5B: Parallel Session 5-B	5C: Parallel Session 5-C	5D: Parallel Session 5-D
12:00 pm-01:00 pm	Lunch Break			
01:00 pm-03:00 pm	6A: Parallel Session 6-A	6B: Parallel Session 6-B	6C: Parallel Session 6-C	6D: Parallel Session 6-D
03:00 pm-03:30 pm	Snack + Coffee Break			
03:30 pm-05:00 pm	7A: Parallel Session 7-A	7B: Parallel Session 7-B	7C: Parallel Session 7-C	7D: Parallel Session 7-D
05:00 pm-05:30 pm	Awarding + Closing Ceremony			

100° C has the same increasing tendency, all oil samples meet IEC standard No.56 of 1991 which is above the standard at 60° C (standard ≥ 30kV/2, 5mm).
pp. 789-793

Transmission Line Switching For Loss Reduction And Reliability Improvement

Atul Kumar Yadav and Vasundhara Mahajan

This paper describes the reduction in losses and improvement in reliability with transient and permanent outage of lines in transmission system. Each line switching is carried out for minimum loss results followed by load flow to get the objective of paper. All the buses are constrained by constant active power except the slack bus, so marginal losses under switching will supplied through slack bus. Power system component under repair considered as permanent outage and transient outages are for short duration. Switching rate for permanent outages will be minimum because it is replaceable but not in transient outage. Reliability is observable key for both the outages. Capacity Outage is used to evaluate the transmission system reliability parameter Expected Energy Not Supplied (EDNS) under load curtailments at the buses.
pp. 794-799

Performance Comparison of Standard Boost Converter and Two-Phase Boost Converter

Beauty Anggraheny Ikawanty, Mochamad Ashari, Taufik Taufik and Dodi Garinto

This paper presents steady-state performance comparison between standard boost converter and two-phase boost converter with reduced input current ripple characteristic. Several performance measurements were investigated under varying load conditions, which include output power, output voltage, input current ripple and efficiency. Results of the study using computer simulation reveal that the standard boost converter yielded input current ripple of 7.35% at full load while the two-phase converter draws a significantly less ripple of 0.01%. The difference, however, is not as pronounced on converter's efficiency at full load with the standard boost converter having 92.4% efficiency while the two-phase boost converter achieved 95.69% efficiency.
pp. 800-804

The Effect of Irradiance on Distribution Power System Stability in Large-Scale Grid-Connected Photovoltaic

Muammar Zainuddin and Frengki Surusa

The purpose of this study was to analyze the effect of solar irradiance in the integration of photovoltaic plants (PV) on the stability of the electric power distribution system. The stability aspects assessed were the stability of the distribution network and the stability response of the synchronous generator which work in parallel with the PV generator. Distribution grid stability includes voltage and frequency stability. The stability response of synchronous generators includes power angle stability, active power stability, and reactive power stability. All aspects of stability were simulated based on four different cases of irradiance, namely 550 W/m2, 650 W/m2, 850 W/m2, and 1000 W/m2. PV generators were connected to a distribution grid using an inverter with MPPT and PV systems without batteries. This study was applied to a case of electrical distribution system in Gorontalo province, Indonesia. One distribution feeder in Gorontalo Province was connected a photovoltaic system of 2000 kWp and synchronous generators that work in parallel. The distribution system was modelled in a single-line diagram of 13-buses. The measurement of every solar radiation intensity change was conducted in every electrical distribution power system change. This study showed that high irradiation in PV plants affects the voltage and frequency stability on the grid by increasing proportionately. However, the high irradiation has an effect on increasing power oscillation at synchronous generators.
pp. 805-810

Optimal Design of Stator Slot Geometry for High-Speed Spindle Induction Motor Applications

Wawan Purwanto, WP

This paper describes the optimal design for the geometry of a stator slot for use in high-speed spindle motor applications. The proposed method consists of the following three steps: first, choose the parameters of the stator slot that has a strong influence on the stator current, stator winding loss, iron loss, total loss, efficiency, and torque by using the analysis of the effects of stator slot geometry; second, create factors and levels in the Taguchi method to obtain the optimal combination of the stator slot parameters from the analysis effect of the parameter results; third, using Genetic Algorithms (GAs) to determine the optimal value from the optimal combination of the results of the Taguchi method. Optimal design and performance analysis was performed using the Finite element Method (FEM) and verification by using equivalent circuit analysis. The optimization results were evaluated by comparing them with original performance. According to the test results and analysis, the optimal design of the stator slot geometry produce better performance than original design.
pp. 811-816

Dynamic Economic Dispatch for 150 kV Sulselbar power generation systems using Artificial Bee Colony Algorithm

Haripuddin Arsyad, Ansar Suyuti, Sri Said and Yusri Syam Akil

The electric power generation in electrical power system is very important in the process of distributing electrical energy to the load with the most optimal generated power and minimum generation costs. With the increase in electric power load requirements and generator fuel costs, economic dispatch is needed in a power generation system to obtain optimal and economic power generation. In this paper, researcher used an artificial bee colony algorithm that is one part of a swarm intelligence algorithms to get the best solution from optimization problems that is also widely used in other fields. The dynamic economic dispatch optimization of the 29 bus and 36 lines, 150 kV Sulselbar power generation system is carried out with consideration to generator power limits and generator ramp rate limits constraint. Simulation testing is done by comparing the simulation results from the same system using the Lagrange method which only considers generator power limit. The voltage stability in the system is also evaluated using L index stability and also in this paper is done loading margin on buses that were considered weak . The results of simulation show that artificial bee colony algorithm is able to provide the best solution of dynamic economic dispatch optimization
pp. 817-822

A Power Sharing Loop Control Method for Input-series Output-parallel Flyback-type Micro-Inverter Using Droop Method

Sandi Kurniawan, Ferdian Ronilaya, Mohammad Hidayat, Erfan Rohadi, Indrazno Siradjuddin and Rachmat Sutjipto

This paper discusses input-series output-parallel (ISOP) flyback-type micro-inverter which is implemented for ac photovoltaic module to achieved higher voltage input and output current rating. The main features of this micro inverter include a stable current injection, lower level harmonic distortion, potentially lightweight and lower cost. Additionally, as the inverter is mounted in a single PV module, the inverter may harvest maximum power when partial shading occurs. However, since the two flyback-inverters are connected in series/parallel, there should be control strategy for each inverter to obtain optimum performance. The strategy to control the inverters are based on a power sharing loop using droop method. Several experiments and simulations are carried out to examine the design and the results show the effectiveness of the proposed control strategy.
pp. 823-828

First Time User Experience Assessment on Web based Online Examination

Krisnawati Krisnawati, Mardhiya Hayaty, Bayu Setiaji and Arief Setyanto

An examination is an important task in the education system to measure the level of students' understanding of teaching material. Replacing paper-based with an online system not only increases the efficiency of its process by reducing the consumption of papers, but also the amount of time spent marking and grading. However, a massive changing in exam operation happens on test participant. This research aims to reveal the user experience in the implementation of a website-based exam system. In particular, to study the first-time user experience including their attempt to understand how to use the application. The user experience is measured by User Experience Questionnaire (UEQ). 40 respondent participated in this research. All the respondent use the exam system for the first time without any prior training. According to the user responses, the first-time user rates the overall system in a good score in good and above average compared to the benchmark. However, the novelty and perspicuity dimension obtain the lowest score. Interviews confirm this value, some respondents put attention to the alternative of the interface in more modern technology such as mobile phone apps. The current interface also needs serious improvement such as font size, and question grouping
pp. 829-834

6D: Parallel Session 6-D

Room: SAMAS Room

2019 International Conference on Information and Communications Technology (ICOIACT)

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Optimal Design of Stator Slot Geometry for High-Speed Spindle Induction Motor Applications

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Abstract—**This paper describes the optimal design for the geometry of a stator slot for use in high-speed spindle motor applications. The proposed method consists of the following three steps: first, choose the parameters of the stator slot that has a strong influence on the stator current, stator winding loss, iron loss, total loss, efficiency, and torque by using the analysis of the effects of stator slot geometry; second, create factors and levels in the Taguchi method to obtain the optimal combination of the stator slot parameters from the analysis effect of the parameter results; third, using Genetic Algorithms (GAs) to determine the optimal value from the optimal combination of the results of the Taguchi method. Optimal design and performance analysis was performed using the Finite element Method (FEM) and verification by using equivalent circuit analysis. The optimization results were evaluated by comparing them with original performance. According to the test results and analysis, the optimal design of the stator slot geometry produces better performance than original design.**

Keywords—Genetic algorithm; High-speed motor; Parameter analysis; Stator slot geometry; Taguchi method; Genetich Algoriths;

I. Introduction

Many industries have begun launching electric energy efficient programs, with various attempts made to improve output power and efficiency, particularly in the new designs of induction motors [1-3]. Small changes in the optimal design of induction motors can increase their efficiency and output power, which has an impact on conserving electrical energy and extending the lifetime of an induction motor. Stator slots have a critical function in creating stator teeth flux density, stator leakage, winding loss, temperature rise, and radial force [4-6]. The geometry of the stator slots used in induction motors provides a flux path and an appropriate design optimization the flux distribution while minimizing loss. Stator windings generate magnetic fields in the stator slot. The cross-section area of the stator slot affects the stator winding loss, core loss, iron loss, and high-speed induction motors require a minimum loss [6-8]. Given of the significance of stator slots, this study investigated the optimal design of the stator slot geometry to improve the efficiency and torque of a spindle motor

The stator slot design of a spindle motor is critical in satisfying performance specifications because the torque speed characteristics are largely determined by the configuration of the stator geometry [25]. A crucial focus is on the slot geometry of the stator, because it is one of the most critical factors for improving the performance of induction motors [8,24,26]. These paper, describes the design of stator slot geometry in high-speed spindle motors. The proposed method involved the following three steps. The first step is define the parameter that have a strong influence on the stator winding loss, iron loss, the total loss, the stator current, torque, and efficiency through the analysis of the effect of the stator slots parameters. The second step is the stator slot parameters which have a strong influence on the results of the first step, will be a factor in the Taguchi method to obtain the optimal combination of the geometry of the stator slots. The third step is the optimal combination produced in the second step will be adopted as a guide to determine the optimum value of the stator slot parameters by using GAs. The results of the Taguchi method and GAs optimization will be tested by using FEM, performance analysis and verified by the equivalent circuit analysis. In this paper, steady-state performance characteristics of the original design and both designs optimization are plotted to facilitate a comparison and discussion. Finally, optimal overall performance is presented and a recommendation is offered for developing a spindle motor with the optimal specifications.

II. Optimization Methodology

A. Initializations

TABLE I. Motor Specifications

Parameter	Value	Parameter	Value
Inner diameter of stator (mm)	70	hs_0 (mm)	0.5
Outer diameter of stator (mm)	120	hs_1 (mm)	0.5
Length of the stator core (mm)	120	hs_2 (mm)	5.5
Outer diameter of rotor (mm)	69.5	bs_0 (mm)	1.3
Inner diameter of rotor (mm)	38	bs_1 (mm)	3.2
Number of stator slot	36	bs_2 (mm)	4.7
Number of rorot slot	32	rs (mm)	0.8

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TABLE II. ORIGINAL DESIGN OF SPINDLE MOTOR

Parameter	Value
Copper loss of stator winding (W)	3944.95
Copper loss of rotor winding (W)	185.02
Iron core loss (W)	103.22
Friction and winding loss (W)	157
Stray loss (W)	280
Total Loss (W)	4670.37
Input power (KW)	18.67
Output power (KW)	13.99
Efficiency (%)	74.98
Torque (Nm)	4.8
Stator current density (A/mm^2)	130.32
Stator thermal load (A^2/mm^2)	3577.38

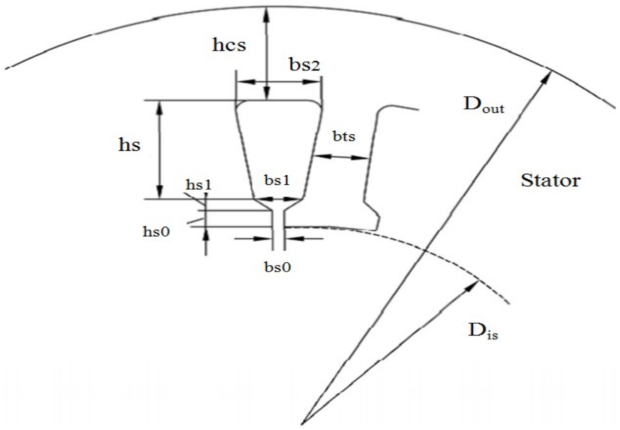


Fig. 1. Rounded semi-closed slot type

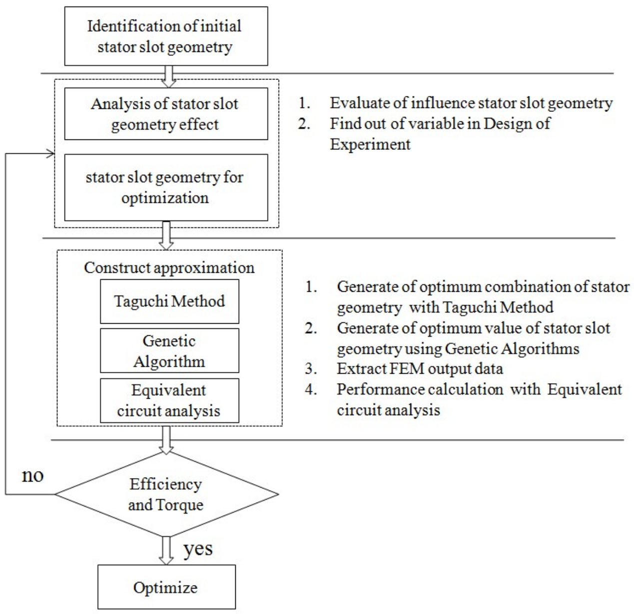


Fig. 2. Outline of the optimization design

In this study, the spindle motor had a rated output 14 KW, four Poles, a Δ connection, 380 V, and could be operated at up to 30.000 rpm. The analyzed spindle motor was constructed as a rounded semi closed stator slot type, shown in Fig. 1 with general spindle motor specification as shown in Table 1. The stator geometry is typically related to the number of conductors per slot. In this study, the number of conductors per slot was 8 turns per slot with a wire diameter of 0.32 mm. Table 2 shows the spindle motor performance following the optimization process and procedure as shown in Fig. 2.

B. The Effect of Stator Slot Geometry

FEM and the equivalent circuit [13] are applied to analyze the effect of the stator slot geometry. FEM software developed by following principles have been applied [16,17], and the equivalent circuit analysis as it has been applied to [18-21]. Based on the analysis that has been done, stator slot geometry is critical in determining the iron loss, stator winding loss, and total loss, which are denotes as hs_2, bs_2, hs_1, and rs. The stator current is effect on the performance of the spindle motor. The stator current instability is affect the magnetizing current, stator thermal load, and specific electric loading. Increasing the stator current will increases the stator winding temperature. When the total loss increases, the efficiency is decreased. By contrast, when the total loss decreases, the efficiency and torque increases. The stator slot geometry is effect on increases or decreases the stator current, efficiency, and torque are hs_2, bs_2, hs_1, and rs. The parameters bs_0, bs_1, and hs_0 are not crucial parameter in the spindle motor performances.

C. Taguchi Method

The Taguchi method can be employed to minimize the number of experiments by determining the most influential variable through analysis. Taguchi parameter provides designers with a systematic and efficient approach to performing numerical experiments, which is necessary when determining the parameters for the optimal geometry design. The parameter analysis revealed that the significant stator slot geometry parameters were hs_1, hs_2, bs_2, and rs. So, in this study, the Taguchi method was performed using 4 factors and 3 levels.

D. Genetic Algorithms

GAs is iterative problem solving techniques and it is used in many engineering fields for finding an optimal solution. GAs is advantageous because they provide a flexible, simple, and intuitive approach to optimization with gives a high probability of success [9,10,12,22,23]. The optimization procedure involves finding a vector $x = (x_1, x_2, ... x_n)$, representing a set of n design variables bounded by $x_L \leq x_i \leq x_U$, $i = 1, 2 .... n$, so that the objective function $f(x)$ is maximized (or minimized) with a set of k constraints $Gj(x) \leq 0$, $j = 1, 2 .... k$. The required optimization functions as follows:

$$\text{Maximize } f_1(x) = \eta$$
$$\text{Maximize } f_2(x) = Ts$$
$$\text{Subject to } X_L \leq X \leq X_U$$

Where X is an independent design variable for the optimization of the stator slot geometry, η is the efficiency, Ts denotes the torque, and X_L and X_U are the Lower and Upper limits of X, respectively. The GA evaluation steps are listed as follow:

Step 1: Define the parameters and objective functions

Step 2: Generate the first population randomly

Step 3: Evaluate the population by using objective function

Step 4: Test for convergence, if satisfied, then stop (otherwise continue)

Step 5: Initiate the reproduction process (selection, crossover, and mutation)

Step 6: After a new generation has been created, return to step 3 to continue with the optimization

The objective function is the motor spindle efficiency In this study, a GAs was used to determine the optimal value of the Taguchi method stator slot geometry parameter results. In this study GAs results with the population set at N = 500, crossover $p_c = 0.85$ and mutation $p_m = 0.05$.

III. Test Results and Analysis

TABLE III. Comparison Results of Stator Geometry

Parameter	Original design	Taguchi Method	GAs
hs_0 (mm)	0.5	0.5	0.5
hs_1 (mm)	0.5	0.65	0.65
hs_2 (mm)	5.5	8	7.4
bs_0 (mm)	1.3	1.3	1.3
bs_1 (mm)	3.2	3	3
bs_2 (mm)	4.7	4.7	4.79
rs (mm)	0.8	2	2

TABLE IV. Comparison Performance of the Motors

Parameter	Original design	Taguchi Method	GAs
Copper loss of stator winding (W)	3944.95	272.86	262.15
Copper loss of rotor winding (W)	185.02	103.72	115.46
Iron core loss (W)	103.22	197.72	186.44
Friction and winding loss (W)	157	158.41	158.23
Stray loss (W)	280	280	280
Total Loss (W)	4670. 37	1012.1	1002.28
Output power (KW)	12.99	13.99	14
Efficiency (%)	74.98	93.26	93.32
Torque (Nm)	4.8	8.9	8.6
Stator current density (A/mm^2)	130.32	13.95	12.89
Stator thermal load (A^2/mm^2)	3577.38	296.81	284.24

Table 3 shows a comparison of the stator slot geometry based on the original design, Taguchi method, and GAs, and Table 4 shows a comparison of performance from the original design with the improved performance results, which was verified by equivalent circuit analysis. The tables show copper loss in the stator winding reduced from 3944.95 W of the original design to 272.86 W of the Taguchi method, and 262.148 W of GAs, and efficiency increased from 74.98% of the original design to 93.26% of the Taguchi method, and 93.32% of GAs.

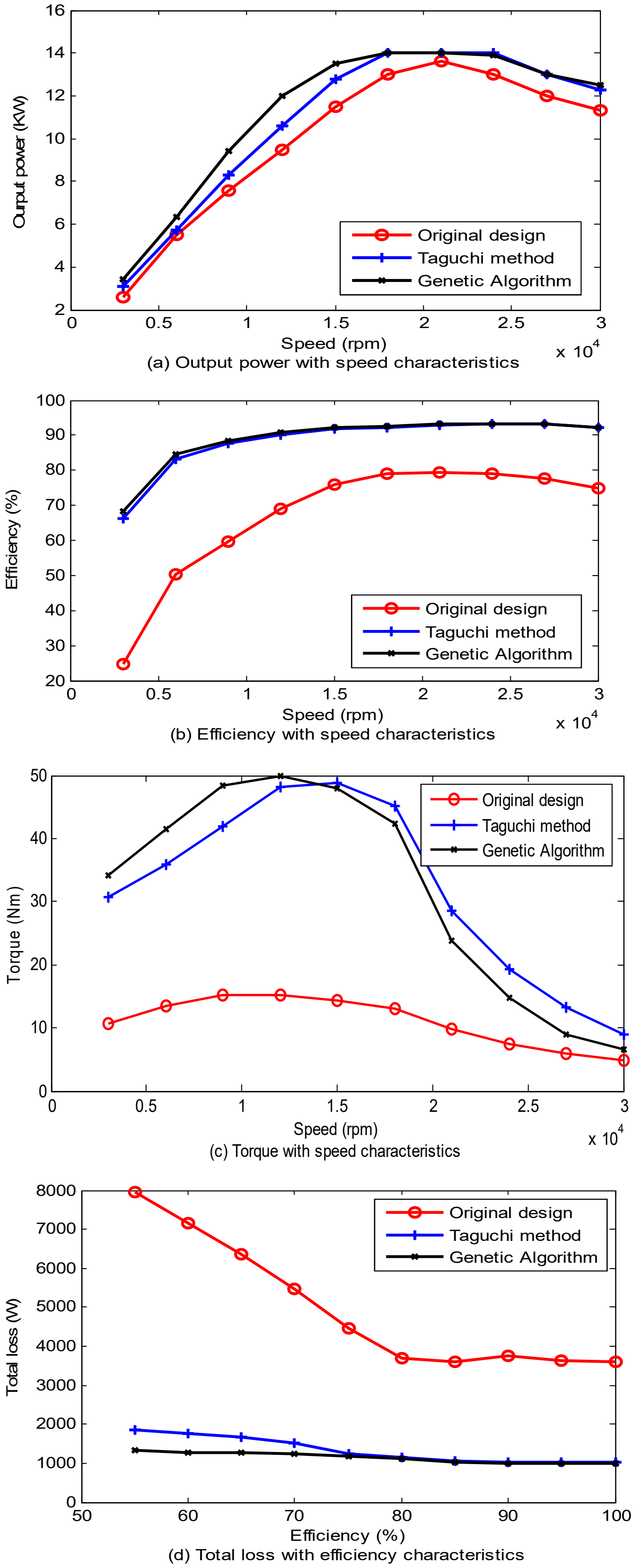


Fig. 3. Performance comparison from original with optimal design

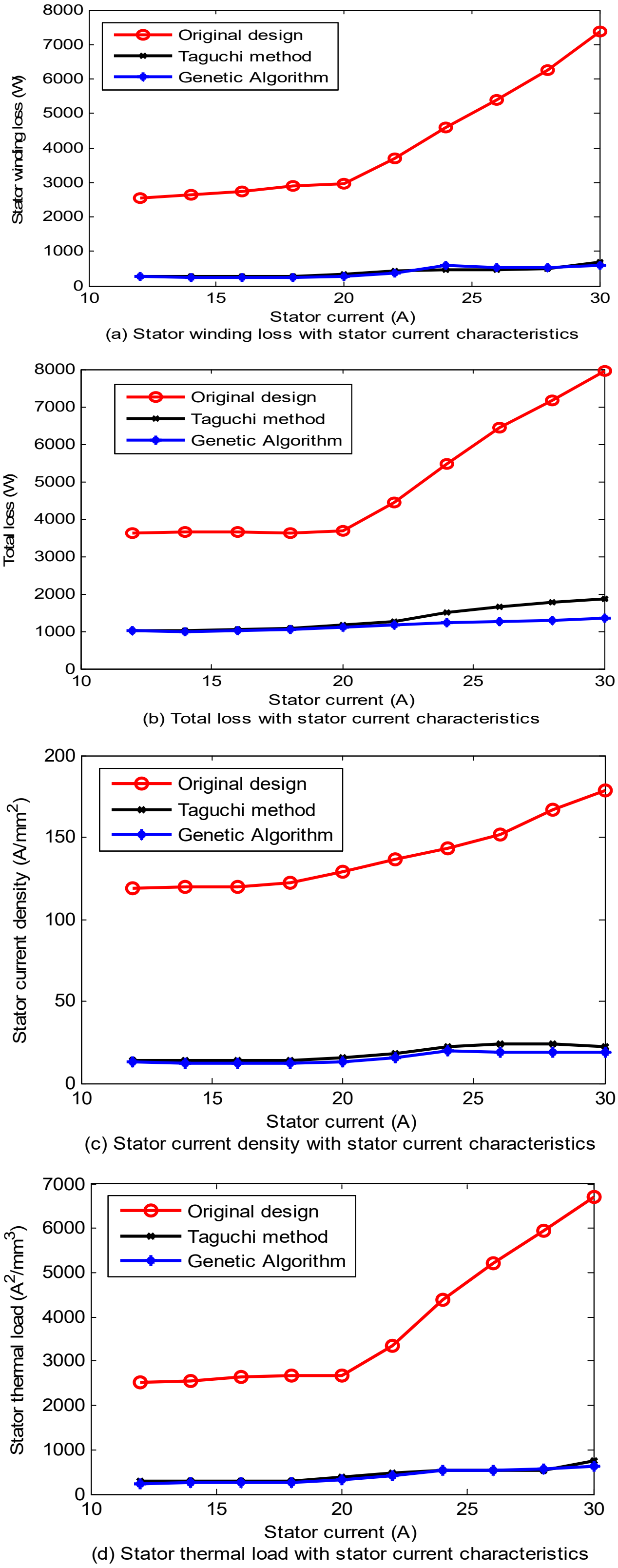


Fig. 4. Effect of stator phase current from original with optimal design

Improving the performance can reduce the potential likelihood of the stator temperature increasing, because of the decrease in the stator current density and stator thermal load. The stator current density was reduced from 130.32 A/mm^2 of original design to 13.95 A/mm^2 of Taguchi method and 12.89 A/mm^2 of GAs. The stator thermal load was reduced from 3577.38 A^2/mm^2 in original design to 296.81 A^2/mm^2 of Taguchi method, and 284.24 A^2/mm^2 in GAs. These results show that the cross-sectional area of the stator slots fitted with the stator winding can improve the spindle motor performance.

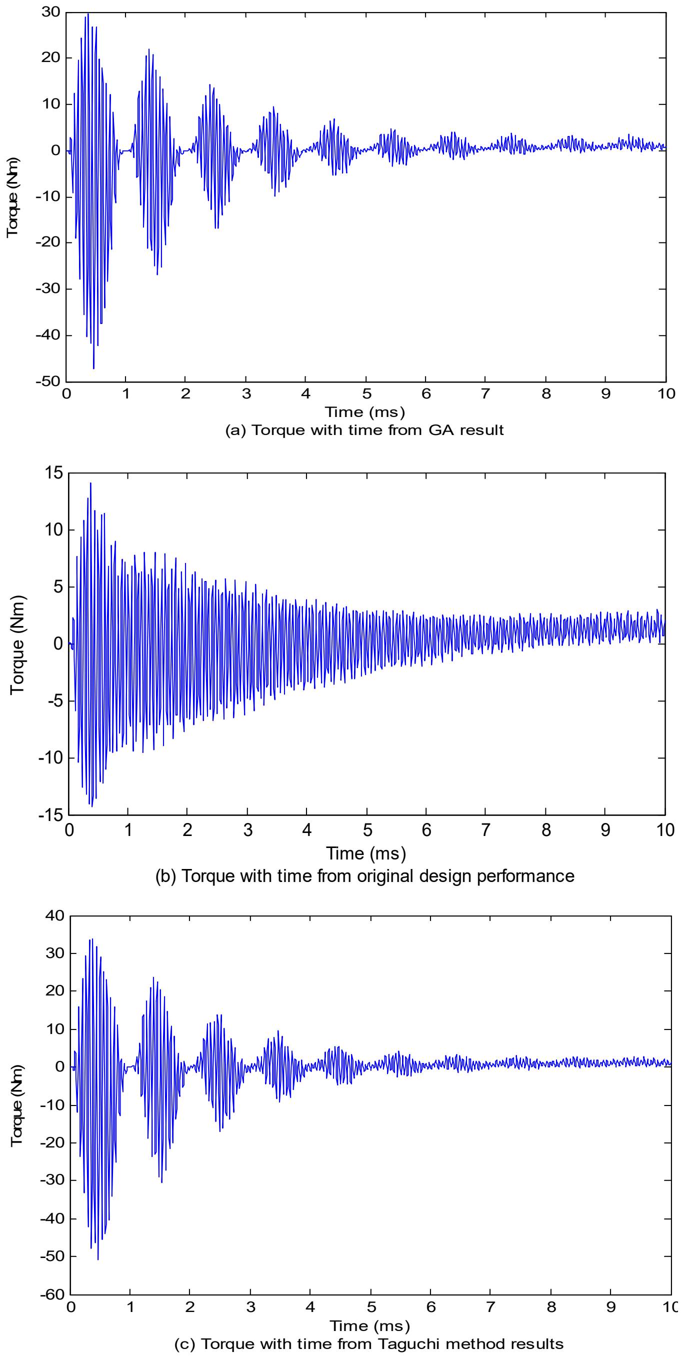
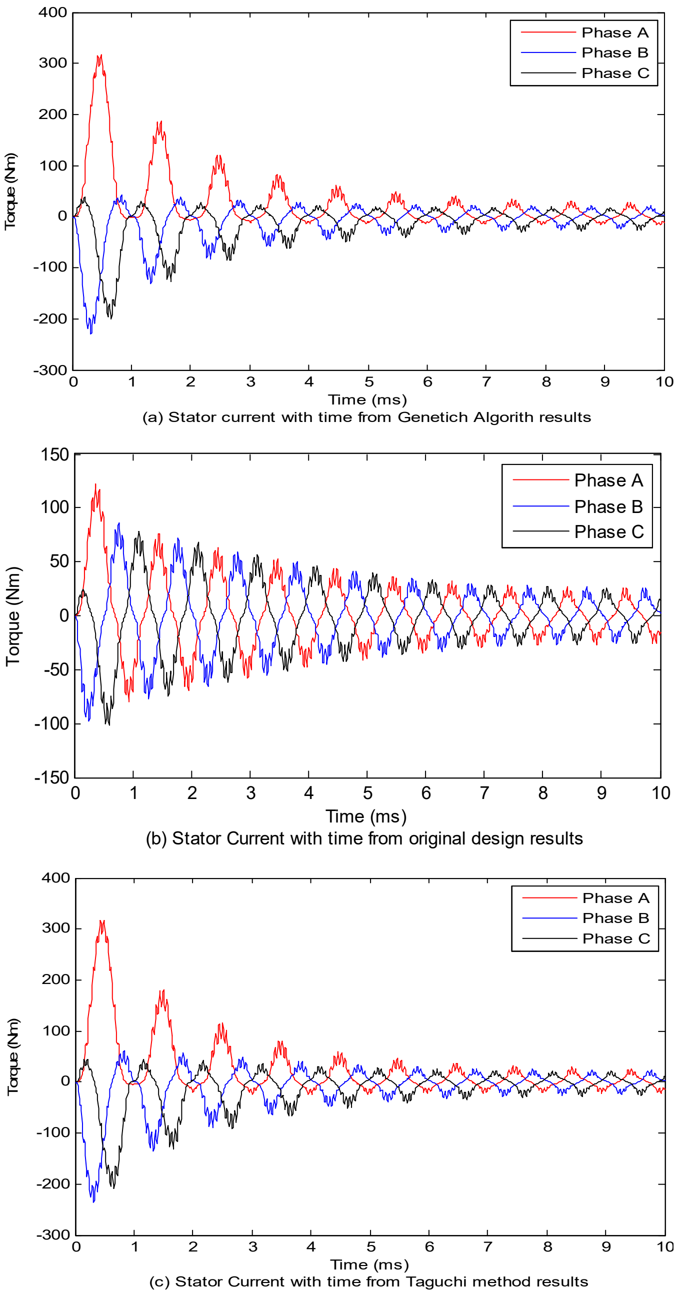


Fig. 5. Torque with time characteristics in spindle motor

Figs. 3(a) and (c) show that the optimal designs obtained using Taguchi method and GAs produced higher output power and torque compared with the original design, and Fig. 3(b) shows that the efficiency can be also increased. Fig. 3 (d) shows that the output power, torque, and efficiency increase as the total loss decreases. The stator current influenced the stator winding loss, total loss, thermal load, and stator current density as shown in Figs.4. Fig. 4(a) shows that the stator winding loss increased with the stator current, which also increased the total loss, as shown in Fig. 4(b). The optimal design produced a lower total loss than the original design. The improved stator slot geometry derived a more favorable slot area for the stator winding and reduced the stator current density, as shown in Fig.4 (c). The optimal design reduced the stator current density compared with the original design and obtained a more favorable stator thermal load, as shown in Fig.4 (d). Furthermore, the decrease in thermal load reduced the temperature rise in the stator winding.



(a) Stator current with time from Genetich Algorith results

(b) Stator Current with time from original design results

(c) Stator Current with time from Taguchi method results

Fig. 6. Stator current with time characteristics in spindle motor

Fig. 5 shows the torque ripple characteristics generated by the spindle motor. The GAs and Taguchi method produced lower torque ripple than the original design, as shown in Figs. 5(a) and (c). The torque ripple was influenced by the high stator current and winding loss. In the original design, the high stator current caused high torque ripple, as shown in Fig. 5 (b). In the initial motion, higher stator current waveform was produced Taguchi method and GAs, as shown in Fig. 6 (a) and (c), however, in normal operating conditions, the optimal design results were more stable with lower torque ripple and stator current compared with the original design. In the original design, the high stator current waveform caused high torque ripple, as shown in Fig. 6 (b). This condition was also caused reduction the efficiency and torque produced by the original design.

IV. Conclusion

This paper presents an optimal design for the stator slots geometry for developing of high-speed induction motors for spindle applications. An analysis of the parameters revealed that the stator slot geometry significantly influences the performance of the spindle motor with the parameters hs_1, hs_2, bs_2 and rs. This result showed that the Taguchi method could be applied with 4 factors and 3 levels, which was tested in experiments by using an L9 orthogonal array. The experimental results, effect plots, and ANOVA show that using the Taguchi method produced the following optimal combination of parameters: hs_1, hs_2, bs_2, and rs_3. The GAs was employed to determining the optimum value of the result of the Taguchi method with the population set $N = 500$, crossover $pc = 0.85$ and mutation $pm = 0.05$. The test results and analysis showed that the performance under the Taguchi method and GAs was superior to that under the original design performance. Thus, two innovative designs for the optimal stator slot geometry were obtained using the Taguchi method and a GAs. The optimal geometry can be used in the development of spindle motors for applications requiring high efficiency and torque, while avoiding increases in temperature and noise.

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