INFLUENCE OF INDUCTION MOTORCYCLE IN ELECTRICITY GENERATOR WHICH INVOLVED STATED TURBINE PROTECTION REVIEWED BY CHARACTERISTIC VIBRATION AND TIME DOMAIN

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ABSTRACT

Study of vibration characteristics of an induction motor that is not controlled and is not closely monitored and regularly adversely affects the vibration and the impact on comfort and engine life. This study aims to investigate the characteristics of vibration on electric-driven generator steam turbine at Limited Liability Perkebunan Nusantara III (PTPN III) Rambutan Tebing Tinggi. The object of research is protected steam turbine engine Palm Oil Processing Factory Company Limited Perkebunan Nusantara III Rambutan Tebing Tinggi. The results of this study show from both the point of measurement at engine speed rpm compared 4800, 4900, and 5000 obtain that the vibration velocity is highest at 120 seconds, 5000 rpm rotation Vertical direction at the point G1.Dari ISO 10816-3 standard for velocity on the highest vibration response measurements at two measurement points on the position of the engine cradle generator of 0.650 x 10-6 m / s Zone A is green, the vibration of the engine is very good and below the allowable vibration.

Keywords : *Induction Motors , Vibrometer , Electric Generators and Steam Turbines Protected*

1. INTRODUCTION

1.1 Background

The development of technology in the present is very rapidly developing, many methods are used to determine the feasibility of a tool to be used. One of them is a very noticeable vibration system to find out whether the machine is still good or comfortable to use. Vibration is one effect that occurs due to the motion caused by differences in pressure and frequency. Vibrations that occur in steam turbines have certain requirements / standards. Vibration engine or vibrating engine is the movement back and forth from a working machine or a machine component. Thus, any component that moves back and forth or oscillates is called vibrating. A machine component can vibrate strongly, small, sooner or later, or silently and heat.

In this study an induction motor from a steam protected steam turbine generator operating at 4800 rpm engine speed, 4900 rpm and 5000 rpm, at the PTPN III palm oil mill. Where the effect of the engine speed and mechanical vibrations occurring on the induction motor can be known based on the vibration that arises, whether it is still in accordance with the limits of the engine vibration which is good or still within the limits of tolerance allowed

1.2 Research Objectives

1.2.1. General purpose

The general purpose of this research is to obtain the characteristic value of vibration based on induction motor rotation on electric generator driven steam turbine protection at palm mill based on time domain

1.2.2. Special purpose

Obtain the value of deviation, speed and acceleration on the engine generator with horizontal and vertical direction.

2. RESEARCH METHODS

2.1. Place and time

This research will be conducted in PKS PTPN III Rambutan - Tebing Tinggi, North Sumatera

2.2. Material, Equipment And Method

2.2.1. Material

In this research the subject of research is induction motor generator on protected steam turbine as seen in picture below.

Figure 3.1 Electric induction motor generator driven steam turbine driven

This research will be conducted in PKS PTPN III in Tebing Tinggi, North Sumatera. Research methods undertaken in the implementation of this study are as follows:
1. Determination of Objectives and Limitations of Problems
2. Installation of tools on the generator holder.
3. Inspection of stability of induction motor rotation..
4. Overall Vibration Measurement and Trending Analysis.
5. Data collection.
6. Processing and Data Analysis.
7. Conclusions and Results

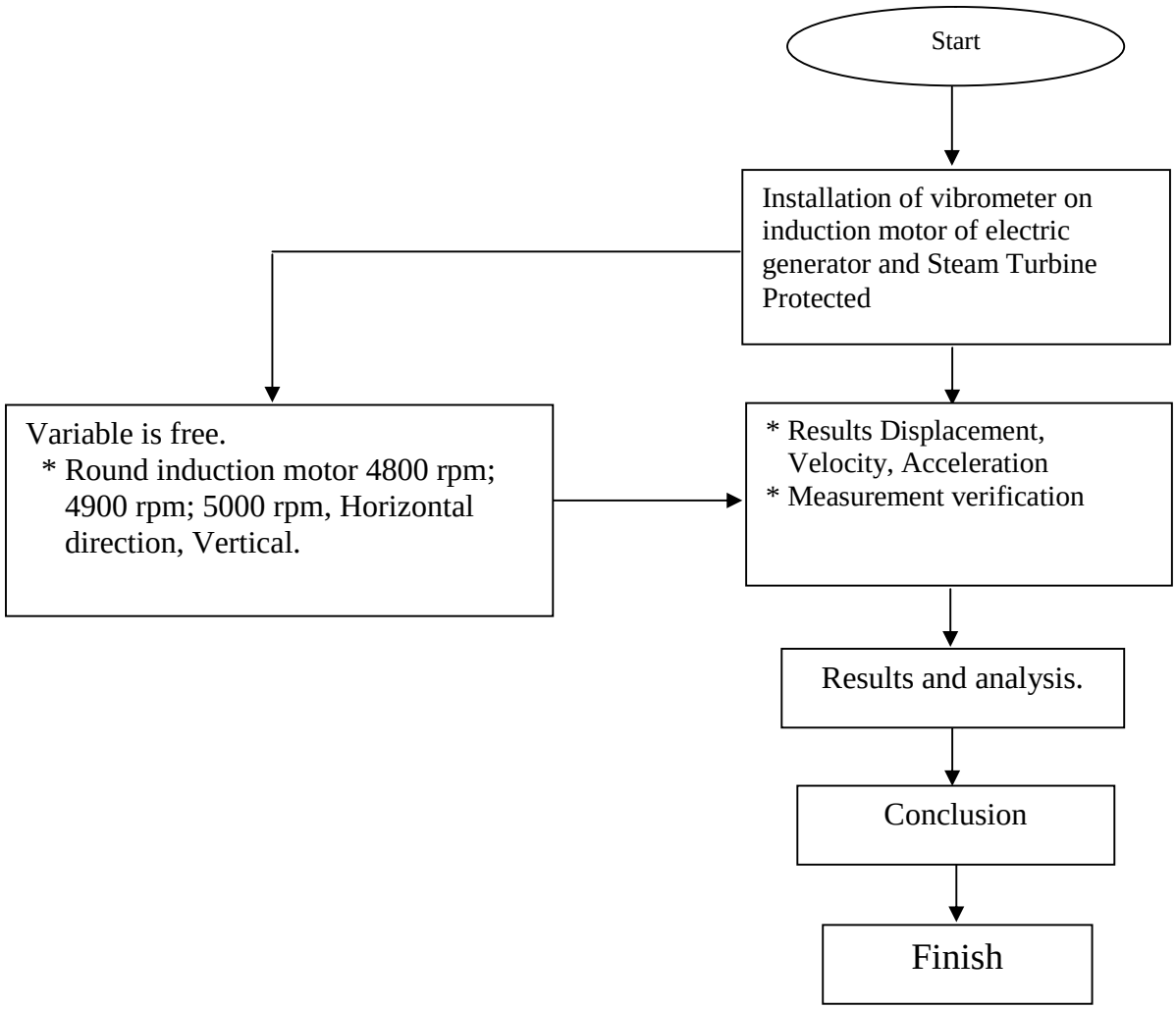
2.3. Variable Observed

1. Displacement or deviation from three-way measurement.
2. Velocity or speed of three-way measurement.
3. Acceleration or acceleration of three-way measurement

2.4. Conceptual framework

Broadly speaking, this research method can be described as in the following flow diagram:

RESEARCH DIAGRAM OF RESEARCH METHODOLOGY



3. RESULT AND DISCUSSION

Table 3.1 The measurement results at point G1 of the steam turbine generator vibration response n = 4800 rpm, in the horizontal and vertical directions.

The price of vibration response in Table 3.1 to Table 3.5 is the average price obtained from

No	Time (s)	G1 Round Point 4800 rpm					
		Horizontal			Vertikal		
		Dis (μm) X	Vel (cm/s) $\dot{X}$	Acc (cm/s^2)	Dis (μm) X	Vel (cm/s) $\dot{X}$	Acc (cm/s^2) $\ddot{X}$
1	20	0.021	0.480	2.300	0.02	0.370	2.300
2	40	0.022	0.500	2.255	0.029	0.430	2.255
3	60	0.018	0.510	2.245	0.027	0.410	2.235
4	80	0.022	0.530	2.235	0.029	0.380	2.225
5	100	0.024	0.520	2.175	0.027	0.400	2.175
6	120	0.022	0.590	2.225	0.025	0.350	2.225
7	140	0.025	0.500	2.200	0.023	0.370	2.220
8	160	0.022	0.540	2.215	0.028	0.350	2.215
9	180	0.018	0.510	2.220	0.025	0.450	2.220
10	200	0.016	0.530	2.200	0.027	0.370	2.215
11	220	0.021	0.520	2.098	0.022	0.350	2.098
12	240	0.018	0.550	2.145	0.025	0.390	2.145
13	260	0.019	0.580	2.155	0.028	0.410	2.155
Rata-rata		0.020	0.528	2.205	0.025	0.387	2.206

1. Horizontal Direction

The angle velocity : $\omega = \sqrt{\frac{\ddot{x}}{x}} = \sqrt{\frac{2.205 x10^{-2} m/s^2}{0.020\ x10^{-6} m}} = \sqrt{1102} = 1050$ rad/s

$$t = arc.\tan \frac{x\omega}{\dot{x}} = arc\ \tan \frac{0{,}020\ x10^{-6} m\ \ x1050}{0{,}528\ x\ 10^{-2} m/s} = 0{,}227 \text{ rad}$$

So obtained period : $t = \frac{t}{\omega} = \frac{0.227}{1050} = 0{,}000216$ s.

Amplitude: $A = \frac{x}{Sin\ \acute{}\ t}$; $A = \frac{0{,}020\ x10^{-6}\,m}{Sin\ 1050.0{,}000216s} =$ 5,052 x 10^{-6}m

	Direction	
	Horizontal	Vertikal
´ (rad/s)	1050	939,36
´ *t* (rad)	0,227	0,346
t (s)	0,000216	`0,000368
A (m)	5,052 x 10^{-6}	3,397x 10^{-6}

Table 3.3 Amplitude point G2 at n = 4800 rpm

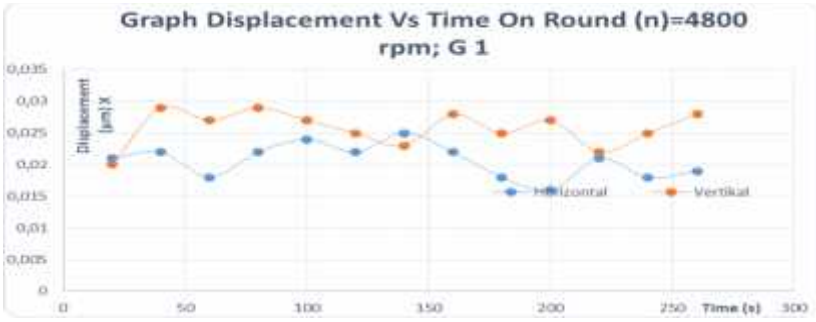
Table 3.4 Amplitude point G 1 at n = 4900 rpm

	Direction	
	Horizontal	Vertical
´ (rad/s)	1050	1359
´ *t* (rad)	0,397	1,306
t (s)	0,000378	0,000960
A (m)	2,887 x 10^{-6}	1,097x 10^{-6}

	Direction	
	Horizontal	Vertical
´ (rad/s)	1059	847,053
´ *t* (rad)	0,270	0,243
t (s)	0,000254	0,000287
A (m)	4,260 x 10^{-6}	2,828 x 10^{-6}

Table 3.5 Amplitude point G2 at n = 4900 rpm

	Direction	
	Horizontal	Vertical
´ (rad/s)	1159	822,90
´ *t* (rad)	0,246	0,289
t (s)	0,000233	0,000352
A (m)	3,819 x 10^{-6}	4,75 x 10^{-6}

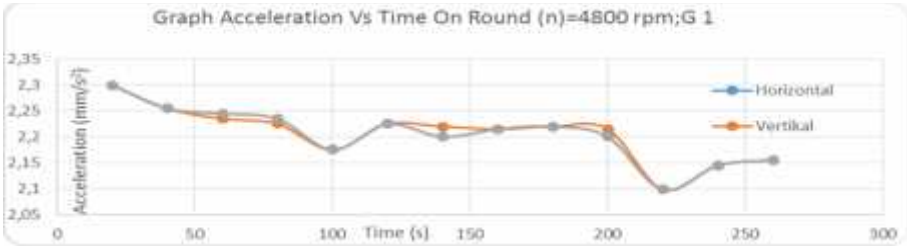


Graph 3.1 The deviation relationship with time at n = 4800 rpm: G1

From graph 3.1 it can be seen that the deviation in the vertical direction is the highest direction with the price of $0.029x10^{-6}$ m, whereas the deviation in the horizontal direction is $0.025x10^{-6}$. The speed measurement for point G1 with n = 4800 rpm can be in graph 3.2

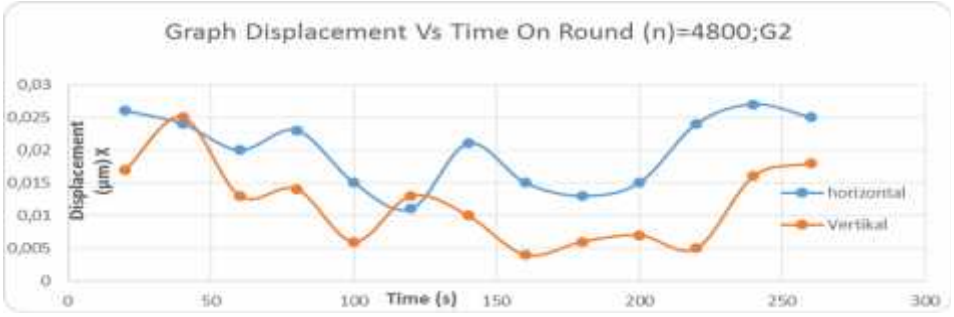
Graph 3.2 Speed relation with time at n = 4800 rpm G1

From graph 3.2 we can see the velocity from horizontal direction is bigger with value $0,590x10^{-3}$ m / s while Vertical direction $0,450x10^{-3}$ m / s. At acceleration measurement for 4800 rpm rotation point G1 can be depicted in graph 3.3.



Graph 3.3 Acceleration Relation with Time at n = 4800 rpm G1

From graph 3.3 can be seen acceleration of direction Horizontal and Vertical amount of acceleration almost same.

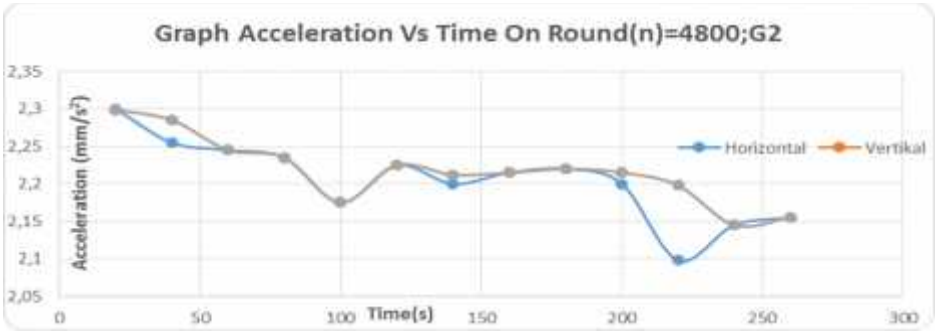


Graph 3.4 The time-drift relationship at n = 4800 rpm: G2

From graph 3.4 it can be seen that the deviation in the horizontal direction is the highest direction with the price $0.027x10^{-6}$ m, whereas the deviation in the Vertical direction is $0.025x10^{-6}$. Measurement speed for point G2 with n = 4800 rpm can be in graph 3.5

Graph 3.5 Speed with time relationship at n = 4800 rpm, G2

From graph 3.5 we can see the velocity from horizontal direction is bigger with value 0,390 x 10^{-3}m/s while Vertical direction $0,200x10^{-3}$ m/s. At the acceleration measurement for G2 point the speed of 4800 rpm can be illustrated in graph 3.6.



Graph 3.6 Acceleration relationship with time at n = 4800 rpm G2

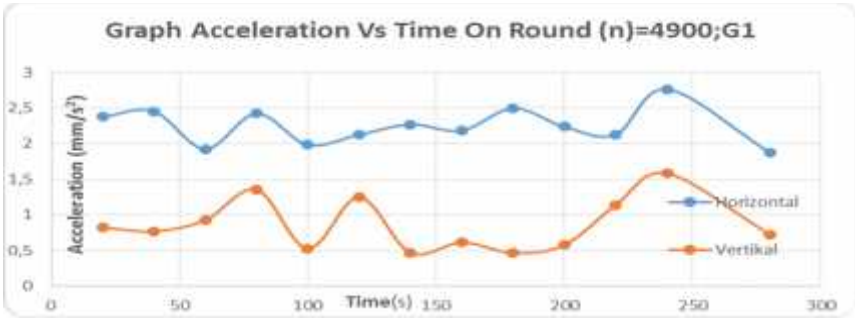
From graph 3.6 we can see the velocity from horizontal direction is bigger with value $2,300x10^{-3}$ m/s while Vertical direction $2,100x10^{-3}$ m/s

Graph 3.7 The time deviation relationship at n = 4900 rpm G1

From graph 3.7 we can see the deviation from the horizontal direction is greater with the value $0.032x10^{-6}$ m/s while the vertical direction is $0.025x10^{-6}$ m/s. On the measurement of velocity for point G1 (n) = 4900 rpm can be described in graph 3.8.

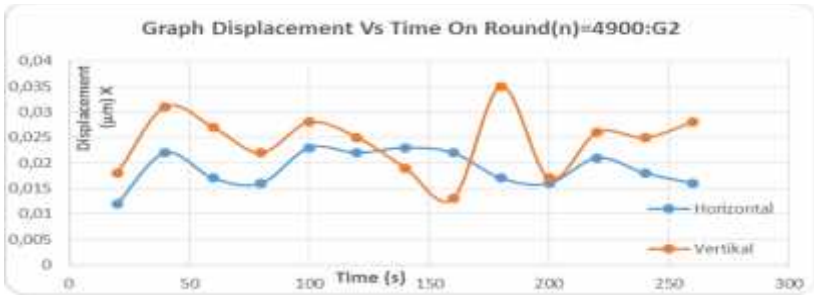
Graph 3.8 Rapid relation with time at n = 4900 rpm G1

From graph 3.8 can be seen the velocity of the vertical direction is greater with the value of $0.614x10^{-3}$ m/s while the horizontal direction of $0.510x10^{-3}$ m/s.At the acceleration measurement for point G1 (n) = 4900 rpm can be depicted in graph 3.9.



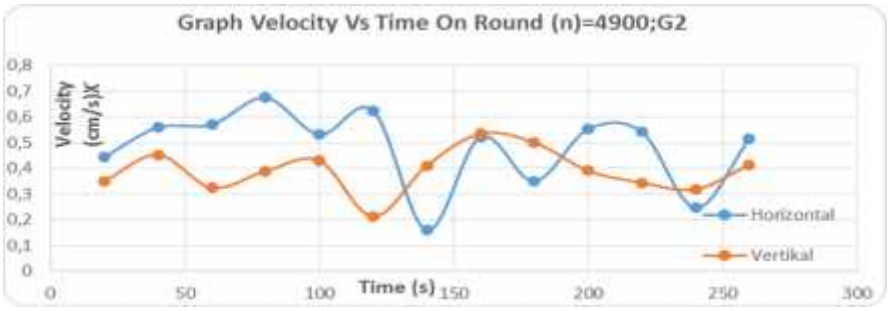
Graph 3.9 Acceleration relationship with time at n = 4900 rpm G1

From graph 3.9 we can see the velocity of horizontal direction is bigger with value $2,762x10^{-3}$ m/s while vertical direction $1,582x10^{-3}$ m/s. At the acceleration measurement for point G2 (n) = 4900 rpm can be illustrated in graph 3.10.



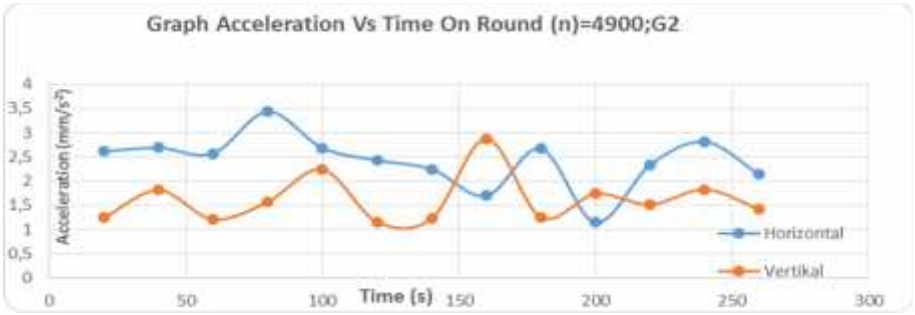
Graph 3.10 The time-drift relationship at n = 4900 rpm G2

From graph 3.10 can be seen the deviation of the vertical direction is greater with the value $0.035x10^{-6}$ m / s while the horizontal direction $0.023x10^{-6}$ m / s. At the measurement of velocity for point G2 (n) = 4900 rpm can be described in graph 3.11.



Graph 3.11 Rapid relation with time at n = 4900 rpm G2

From graph 3.11 can be seen Speed of direction Horizontal bigger with value 0,675x10^{-3} m/s whereas Vertical direction 0,535x10^{-3} m/s. At acceleration measurement for point G2 (n) = 4900 rpm can be depicted in graph 3.12.



Graph 3.12 Acceleration relationship with time at n = 4900 rpm G2

From graph 3.12 can be seen acceleration from horizontal direction is bigger with value 3,435x10^{-3} m/s while Vertical direction 2,875x10^{-3} m/s.

4. CONCLUSIONS AND SUGGESTIONS

4.1 Conclusions

The result of analysis based on vibration characteristic and time domain can be concluded as follows:

1. The lowest displacement is 0.004x m at 160 seconds, 4800 rpm rotation Vertical direction at point G2, Displacement highest is 0.031x m at 40 seconds, 5000 rpm rotation Horizontal direction at point G1
2. The lowest Velocity is 0.110 m / s at 240 seconds, 4800 rpm rotation of Vertical direction at G2 point, Velocity (Highest speed) is 0.650 m / s at 120 seconds, 5000 rpm rotation Horizontal direction.
3. Acceleration (acceleration) lowest is 0.468 m / s2 at 140 seconds, rotation 4900 rpm vertical direction at point G1.
   Acceleration (acceleration) highest is 3.40 m / s2 at 80 seconds round 5000 rpm horizontal direction at point G1.
4. From both measuring points at 4800,4900,5000 rpm comparable engine speed is obtained that the highest vibration speed is highest at 120 seconds, 5000 rpm rotation Vertical direction at point G1.
5. From the ISO 10816-3 standard for velocity on the measurement of the highest vibration response at two points of measurement at the position of the generator engine holder of 0.650 x 10-6 m / s Zone A is green, the vibration of the machine is excellent and below the allowable vibration.

4.2 Suggestions

By doing this research the authors feel the need to suggest to their next research colleagues:

1. Continuing this study by changing the independent variable in terms of changes in pressure and fluid capacity used.

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