International Journal of Engineering and Science Invention (IJESI)
ISSN (Online): 2319-6734, ISSN (Print): 2319-6726
www.ijesi.org ||Volume 12 Issue 6 June 2023 || PP 41-44

Use of GUI Model for Performance Evaluation Of Three Phase Induction Motor Based On No Load And Blocked Rotor Test

K.K. Gautam[1], Arun K.S. Tomar[2]
[1] *(Department of Electrical Engineering, RJIT Tekanpur, India)*
[2] *(Department of Electrical Engineering, RJIT Tekanpur, India)*

ABSTRACT: *The asynchronous polyphase induction motor has been the motor of choice in industrial settings for about the past half century because power electronics can be used to control its output behavior. In past years, the dc motor was widely used because of its easy speed and torque contro-llability. The two main reasons why this might be are its ruggedness and low cost. The induction motor is a rugged machine because it is brushless and has fewer internal parts that need maintenance or replacement. This makes it low cost in comparison to other motors, such as the dc motor. Because of these facts, the induction motor and drive system have been gaining market share in industry and even in alternative applications such as hybrid electric vehicles and electric vehicles. In this dissertation work obtained the result of indirect test (no load and blocked rotor) on three phase induction motor. And calculate Thevenin equivalent circuit parameters and also evaluate the performance parameters by generating graphical user interface (GUI) model by using Matlab programming.*

Keyword - *Induction motor, matlab, GUI model, etc*

Date of Submission: 02-06-2023 Date of Acceptance: 13-06-2023

I. INTRODUCTION

The induction motor is by far the most widely used choice for development application in industry and in the tertiary sector. Being both rugged and reliable, it is also the preferred choice for the variable-speed drive applications. Low cost, high reliability, fairly high efficiency, coupled with its ease of manufacture, makes it readily available in most parts of the world. The typical constitution of a Squirrel-Cage Induction Motor, which is composed by three sets of stator windings arranged around the stator core. There are no electrical connections to the rotor, which means that there are no brushes, commutator or slip rings to maintain and replace. Large induction motor can also have a wound rotor [1, 3] .

For calculating efficiency and torque using Thevenin Equivalent model of three phase induction motor as shown in fig: 1.1.

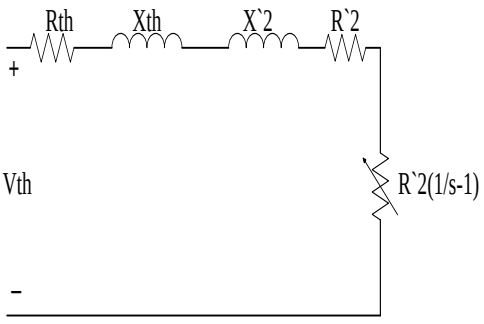

Fig: 1.1
Thevenin Equivalent Circuit of 3 Phase Induction Motor

II. METHODOLOGY OF DETERMINING INDUCTION MACHINE TO DIFFERENT QUANTITIES FOR PERFORMANCE EVALUATION

Applied these parameters using the Matlab software to obtained desired induction machine performance

III. PARAMETER ESTIMATION INDUCTION MOTOR TESTS

Performance of three phase induction motor calculated by indirect test. Indirect test are no load and blocked rotor test .From these test also calculates the equivalent circuit parameters of induction motor

No-Load Test: Rated voltages are applied to the stator terminals at the rated frequency with the rotor uncoupled from any mechanical load. Current, voltage and power are measured at the motor input. The losses in the no-load test are those due to core losses, winding losses, windage and friction.

Blocked Rotor Test: The rotor is blocked to prevent rotation and balanced voltages are applied to the stator terminals at a frequency of 25 percent of the rated frequency at a voltage where the rated current is achieved. Current, voltage and power are measured at the motor input.

IV. Importance Of Parameter Estimation

On the basis of above test , it is clear that the performance evaluation for three phase induction motor is evaluated and these test is carried out to give the correct information regarding induction machine this gives the importance of these parameter to have certain characteristics has been obtained to analysis the machine performance .

V. RESULTS

Fig: 1.2 GUI MODEL

No Load Test Calculations: Table- 1

S.N.	*SPECIFICATIONS*	*VALUES*
1.	*Stator Resistance*	*2.8 ohm*
2.	*Line to line voltage*	*2200 V*
3.	*No load Current*	*4.5 A*
4.	*No load Input Power*	*1600 W*
5.	*Phase Voltage at no load*	*1270.17 V*
6.	*No load Impedance*	*282.26 ohms*
7.	*No Load power factor*	*0.093*

8.	*Power factor angle*	*84.64 deg*
9.	*Magnetizing branch volt*	*1257.57 V*
10.	*Current through Xm ,Im*	*4.48 A*
11.	*Current through Rc , Ic*	*0.41 A*
12.	*Magnetizing Reactance*	*280.68ohms*
13.	*Core Resistance*	*2994.99ohms*
14.	*Magnetizing Impedance*	*26.6+278.2i ohms*
15.	*Approximate Reactance*	*1.5754 ohms*
16.	*Stator Copper Losses*	*170.1 W*
17.	*Rotational Losses*	*1429.9 W*

Blocked Rotor Test Calculations :Table-2

S.N.O.	SPECIFICATIONS	VALUES
1.	Full load Line Voltage	270 V
2.	Full load Phase Voltage	155.8846 ohms
3.	Full load Current	25 A
4.	Full load Impedance	6.2354 ohms
5.	Full load Power	9000 W
6.	Full load Power factor	0.7698
7.	Power factor angle	39.664 degree
8.	Full load Impedance	4.8+3.9799i ohm
9.	Rotor resistance	2 ohms
10.	Approximate	2.4045 ohms

Thevenin Equivalent Circuit Parameter: Table- 3

S.N.	SPECIFICATIONS	VALUES
1.	Thevenin Voltage	1263.0812 V
2.	Thevenin Resistance	2.7688 ohms
3.	Thevenin Reactance	1.5754 ohms

Calculation of Starting Sand Pull-Out Torque Table: 4

S.NO.	SPECIFICATIONS	VALUES
1.	**Rated frequency , f**	**50 Hz**
2.	**No. of poles , P**	**6**
3.	**Synchronous speed , Ns**	**1000 rpm**
4.	**Synchronous speed ,Ws**	**104.7198 rad/sec**
5.	**Starting Torque, Tstart**	**2369.20**
6.	**Slip for Tmax , Sm**	**0.41251**
7.	**Maximum Torque,Tmax**	**3000.06**

VI. COMPARISON OF RESULTS: Table: 5

Items	Normal[14]	Proposed Mat lab Based Programming
Full Load Slip	**0.0699**	**0.0416**
Efficiency	**0.80309**	**0.893**
Starting Torque	**2289.8945**	**2369.2083**

VII. GRAPH RESULTS (shown in Fig: 1.3)

1) SLIP V/S SPEED
2) SPEED V/S TORQUE
3) SLIP V/S TORQUE
4) SLIP V/S EFFICIENCY

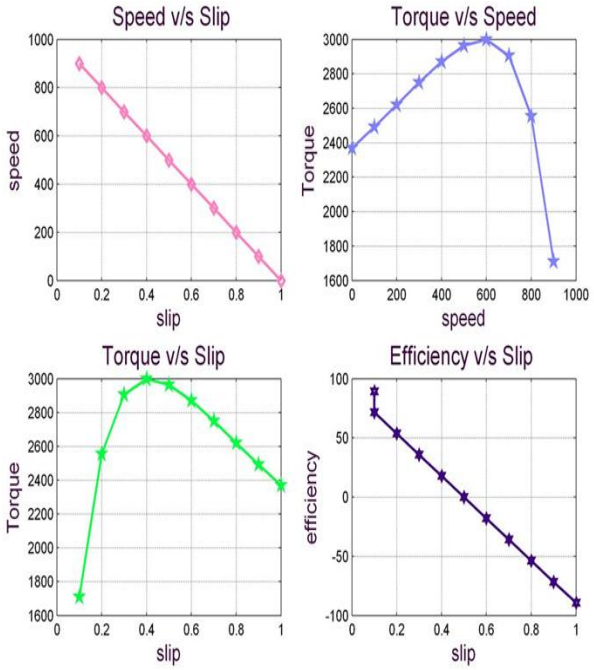

Fig: 1.3, Comparative Characteristics

CONCLUSION AND FUTURE WORK

In this paper a generate the GUI model for three phase induction motor taking the results of indirect test of three phase induction motor , I got various parameters results in form of improved efficiency , better result of various torque and decrease in slip with increase in efficiency . I also plot the graphs between various GUI results as speed-slip, torque-slip, efficiency-slip and torque speed characteristics various results and obtained slip at maximum torque and comparing the results so, I got improvement in efficiency. Max torque, starting torque and decreasing in slip compared to the normal operation.

APPENDIX-I

The results of the no-load and blocked rotor tests on a three-phase, 60hp, 2200 V, six-pole, 60 Hz, squirrel-cage induction motor are shown below. The three-phase stator windings are wye-connected.

No-load test Frequency = 50 Hz
Line-to-line voltage = 2200 V
Line current = 4.5 A
Input power = 1600 W
Blocked-rotor test Frequency = 15 Hz
Line-to-line voltage = 270 V
Line current = 25 A
Input power = 9000 W
Stator resistance 2.8 S per phase

REFERENCES

[1]. ISR-University of Coimbra, Motors Study Group, "Actions to Promote Energy-Efficient Electric Motors", DGXVII, European Commission, October 1996**;**
[2]. European Commission, "European Energy to 2020", Directorate-General for Energy (DG XVII), spring 1996;
[3]. Bose, Bimal K., "Power Electronics and Variable Frequency Drives", Technology and Applications, IEEE Press, USA, 1996;
[4]. Leonhard, Werner, "Control of Electrical Drives", Springer-Verlag Berlin Heidelberg NewYourk, 1997;
[5]. Nasar S. A.; Boldea, Ion: "Electric Drives", CRC Press LLC, Florida, 1999;
[6]. De Almeida, Aníbal; Bertoldi, Paolo; Falkner, Hugh: "Energy Efficient Improvements in Electric Motors and Drives", Springer-Verlag, Berlin, 2000;
[7]. Frank J. Bartos, "Reliability, Ease of Use Widen AC Drives' Application Harizons", Control Engineering News, page 55, February1992.
[8]. NEMA Publication # MG 1, ref MG-1.41.2, table 12.6B
[9]. Eaton Dynamatic Electric Drive Applications Guide page M-37.
[10]. Dennis P. Connors, Dennis A. Jarc, Roger H. Daugherty "Considerations in Applying Induction Motors with Solid-State Adjustable Frequency Controllers", IEEE Transactions on Industry Applications, Vol 1A-20, no. 1, January/February 1984.
[11]. John B. Mitchell, "Inverter Power Factor and Noise", Power Transmission Design magazine, page 45, 46.
[12]. Derek A. Paice, "Harmonic Issues and Clean Power Controllers", Westinghouse Electric Corp, Presented at PCIM '90, Oct 25, 1990.