Group5_Exp7

AIM : To compute the equivalent circuit parameters of a 3-ɸ induction machine using the no-load and blocked rotor tests.

PROCEDURE :

1.No load Test:

- Open a Blank Model in Simulink
- Select the preset model of Asynchronous Machine with name plate reading (5HP,460V,60Hz,1750rpm)
- Make a circuit as shown in Circuit Diagram in MATLAB section.
- Set the voltage in Three-Phase Programmable voltage source to 460V(rated voltage) and Load Torque(T_m) to 0.
- Take the readings in voltage measurement,Current measurement and Power measurement devices respectively to get V_O, I_O and P_O.

2.Blocked Rotor Test:

- Open a Blank Model in Simulink
- Select the preset model of Asynchronous Machine with name plate reading (5HP,460V,60Hz,1750rpm)
- Make a circuit as shown in Circuit Diagram in MATLAB section.
- Adjust the voltage in Three-Phase Programmable voltage source so as to get Rated Current (I_{rated}) in the current measurement block.
- Also,set the speed of the rotor (w_m) to 0.
- Now, take the readings in voltage measurement,Current measurement and Power measurement devices respectively to get V_{BR}, I_{BR} and P_{BR}.

CIRCUIT DIAGRAM IN MATLAB:

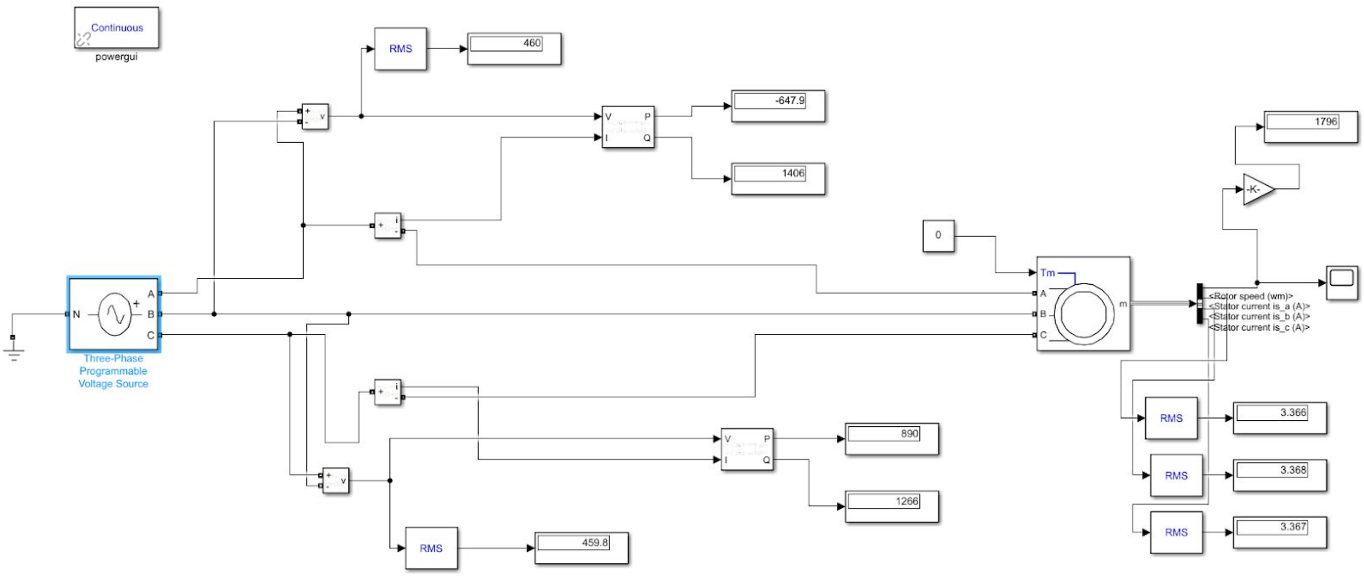

Figure1:Circuit Diagram in simulink for No load test

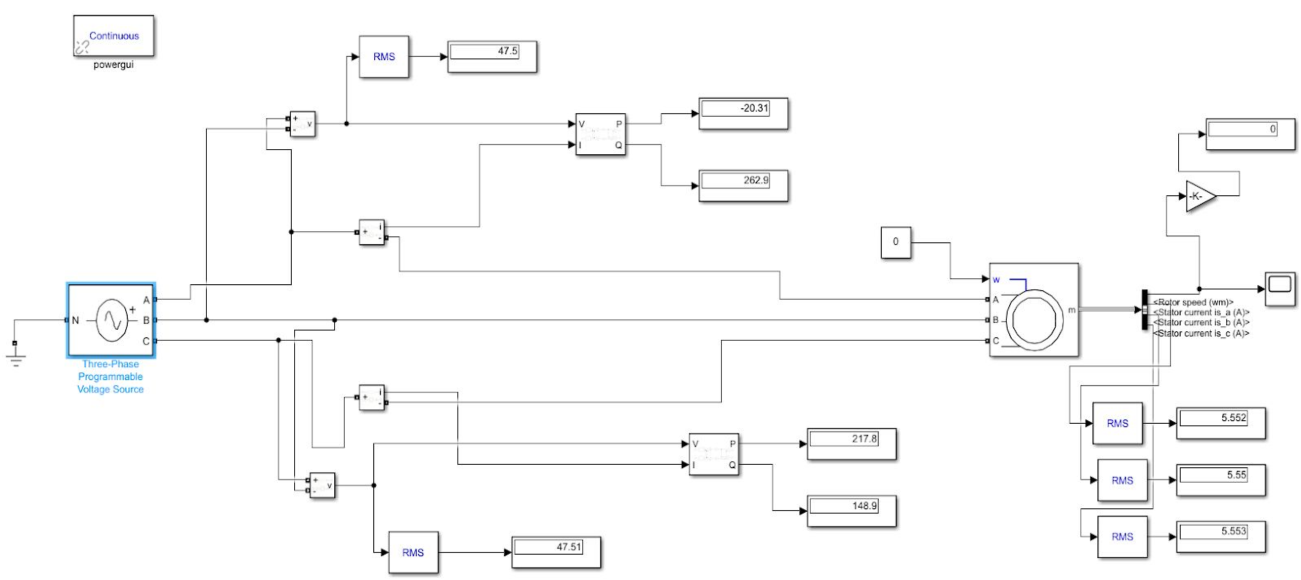

Figure2:Circuit Diagram in simulink for Blocked Rotor test

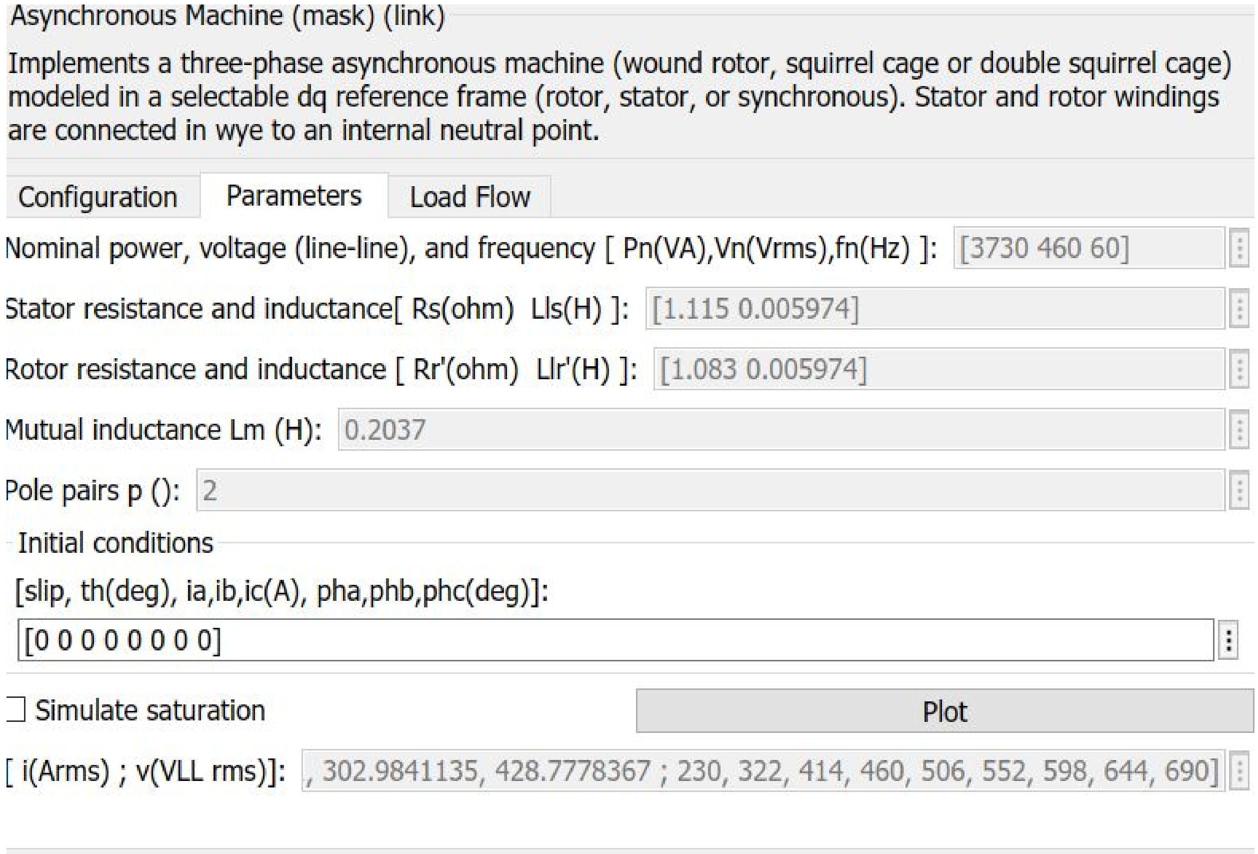

Figure3:Asynchronous Machine Parameters for (5HP,460V,60HZ,1750RPM) model

CALCULATIONS AND RESULTS:

1.Here for this machine, V_{rated}=460V ,N_{rated}=1750rpm,f=50Hz,P=50HP,Pf=cosϕ=0.85,Efficiency=1

2.We can calculate I_{rated} as

$$I = \frac{P \cdot 745.699872}{\sqrt{3} \cdot V \cdot \cos\varphi \cdot \eta}$$

==> I_{rated}=5.50A

3.Also,here the net power P_O or P_{BR} is the

⇒ P_{net}= Wattmeter1 reading + Wattmeter 2 reading.

4.The stator resistance R_1=1.115Ω(Figure3) which is obtained from Machine Parameters.

No load Values :-

V_o	460V
I_o	3.36A
P_o	890-674.9 = 242.1W

Blocked-Rotor Values :-

V_{BR}	47.5
I_{BR}	5.50A
P_{BR}	217.8-20.31 = 197.28W

$$Z_0 = \frac{(V_0/\sqrt{3})}{I_0} = \frac{460}{\sqrt{3}\cdot(3.36)} = 79.04\,\Omega$$

$$R_0 = \frac{P_0/3}{I_0^2} = \frac{242.1}{3\times(3.36)^2} = 7.14\,\Omega$$

$$X_0 = \sqrt{Z_0^2 - R_0^2} = 78.71\,\Omega$$

$$Z_{BR} = \frac{(V_{BR}/\sqrt{3})}{I_{BR}} = \frac{47.5}{\sqrt{3}\times 5.5} = 4.98\,\Omega$$

$$R_{BR} = \frac{(P_{BR}/3)}{I_{BR}^2} = \frac{197.4}{3(5.5)^2} = 2.17\,\Omega$$

$$X_{BR} = \sqrt{Z_{BR}^2 - R_{BR}^2} = 4.48\,\Omega$$

$$X_1 + X_2' = 4.48 = X_{BR}$$

Taking, $X_1 = X_2' = \frac{X_{BR}}{2} = 2.24\,\Omega$

$$\boxed{\therefore\ X_1 = 2.24\,\Omega\ ,\ X_2' = 2.24\,\Omega}$$

$$X_m = X_0 - X_1 = 78.71 - 2.24$$

$$= 76.47\,\Omega$$

$$\boxed{X_m = 76.47\,\Omega}$$

$$R_1 = 1.115\,\Omega$$

$$R_2' = (R_{BR} - R_1)\left(\frac{X_m + X_2'}{X_m}\right)^2$$

$$= (2.17 - 1.115)\left(\frac{76.47 + 2.24}{76.47}\right)^2$$

$$\Rightarrow \boxed{R_2' = 1.11\,\Omega}$$

$$R_{iwf} = \frac{X_m^2}{R_o - R_1} = \frac{(76.47)^2}{7.14 - 1.115} = 970.5\,\Omega$$

$$\boxed{\therefore\ R_{iwf} = 970.5\,\Omega}$$

$$\boxed{\begin{array}{l} \therefore\ R_1 = 1.115\Omega,\ X_1 = 2.24\Omega,\ X_m = 76.47\,\Omega, \\ R_{iwf} = 970.5\Omega,\ R_2' = 1.11\Omega,\ X_2' = 2.24\,\Omega \end{array}}$$

OBSERVATIONS :

STATOR IN STAR
OBSERVATIONS
V_O =460V
I_O =3.36A
P_O =242.1W
V_{BR} =47.5V
I_{BR} =5.50A
P_{BR} =197.49W

RESULTS AND CONCLUSION :

Rated Voltage and Rated Current

STATOR IN STAR
V_{rated} = 460V
I_{rated} = 5.50A

Here, the voltage is line-to-line voltage and the current is line current.

Z_O =79.04Ω
R_O =7.14Ω
X_O =78.71Ω
Z_{BR} =4.98Ω
R_{BR} =2.17Ω
X_{BR} =4.48Ω
R_1 =1.115Ω
R'_2 =1.11Ω
X_1 =2.24Ω
X'_2 =2.24Ω
R_i =970.5Ω
X_m =76.47Ω

COMMENTS:

1.We can observe that the calculated values of machine parameters is approximately equal to the actual preset model parameters in Fig(3).

MEMBERS OF TEAM :

1. G.Yashwanth Naik - EE18BTECH11017
2. P.Aashrith - EE18BTECH11035