IM Report

Name: Li Xin

HDU Number: 22320404

ITMO Number: 375334

TASK1 for 08/10/2024 «Modelling 3phase induction motor»

1. Create model of induction motor that supplied by 3ph sourse " 01 Task_Asynchronous Machine_modelling_and_remarks.pdf"

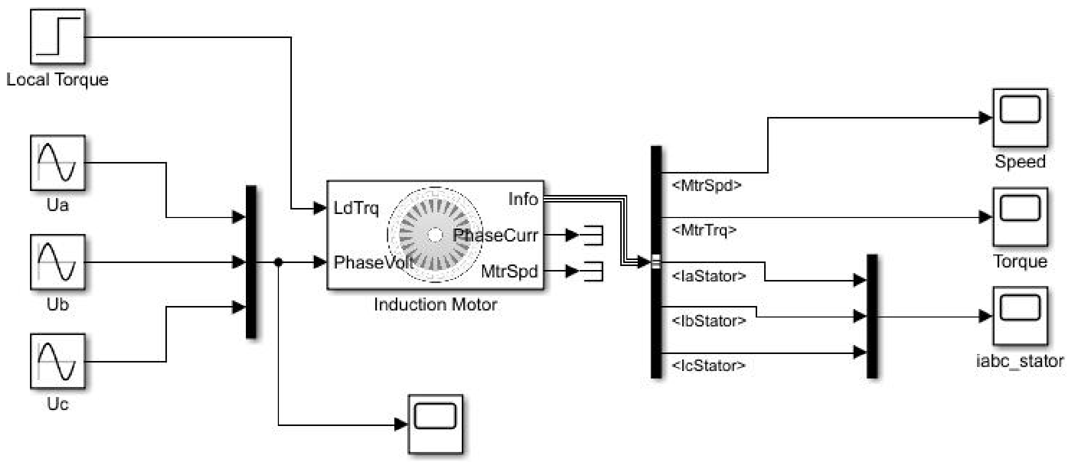


Figure 1. The Model of Induction Motor

2. Use data in block of "Induction motor" " 01 Task_Asynchronous Machine_modelling_and_remarks.pdf"

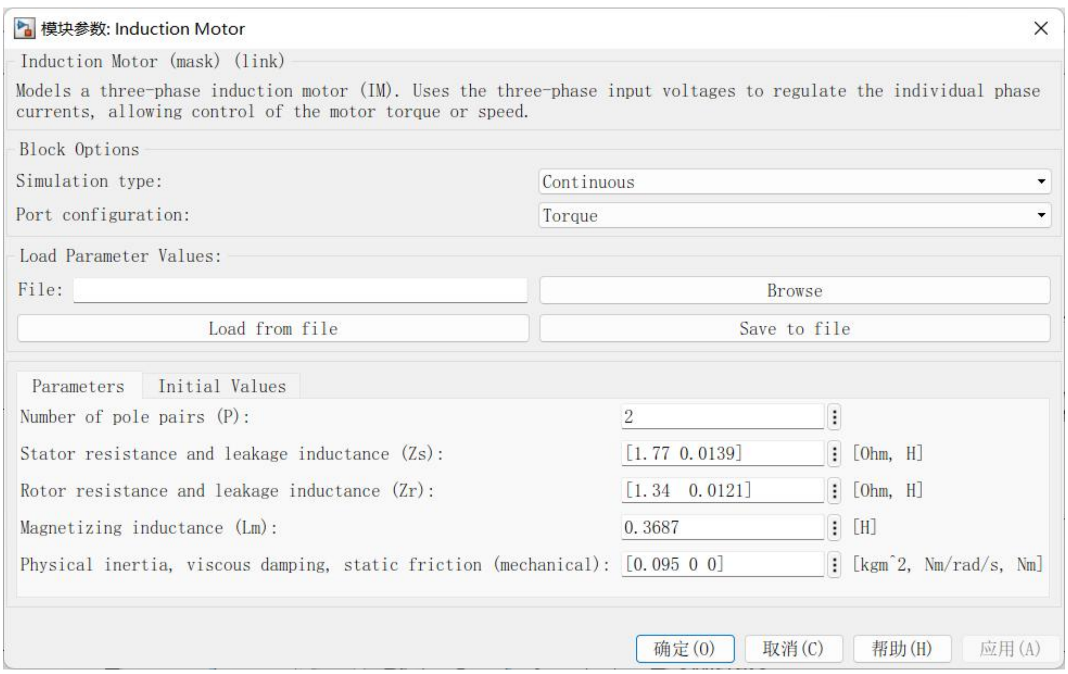


Figure 2. The Data of Introduction Motor

3. Use data in blocks of "sin wave sourse" " 01 Task_Asynchronous Machine_modelling_and_remarks.pdf"

Figure 3. The Data of Three Blocks of Sine Wave

4. Simulate start of the motor and shown firgures of speed, torque, stator's currents (*firgure 4* in report)

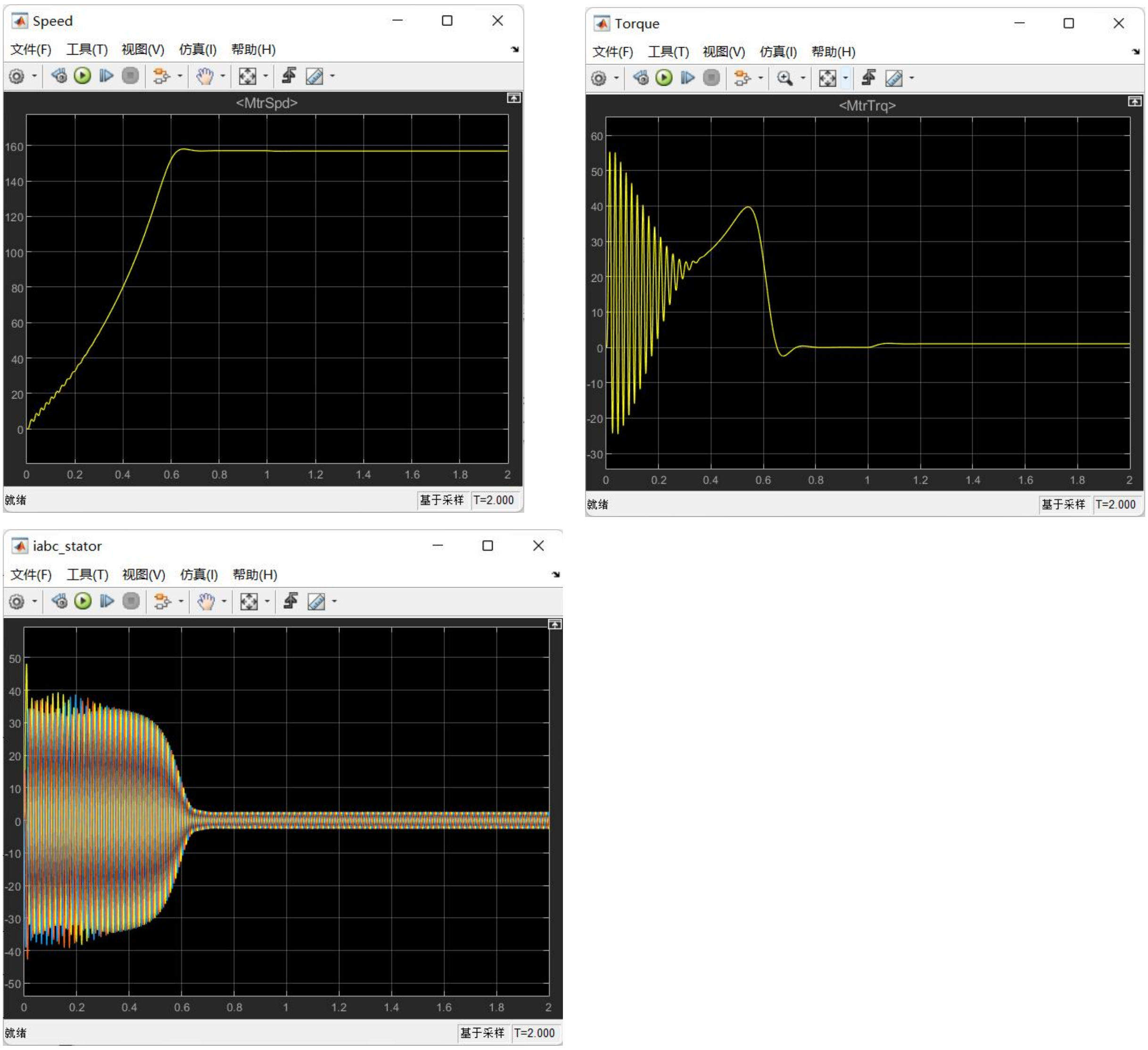


Figure 4. Start motor: motor transients (speed, torque, currents) when connected to a three-phase power supply (moment of inertia J=0.095)

Please calculate value of no-load speed (synchronous speed) and insert formula in your report and compare with value of steady-state speed in your figure

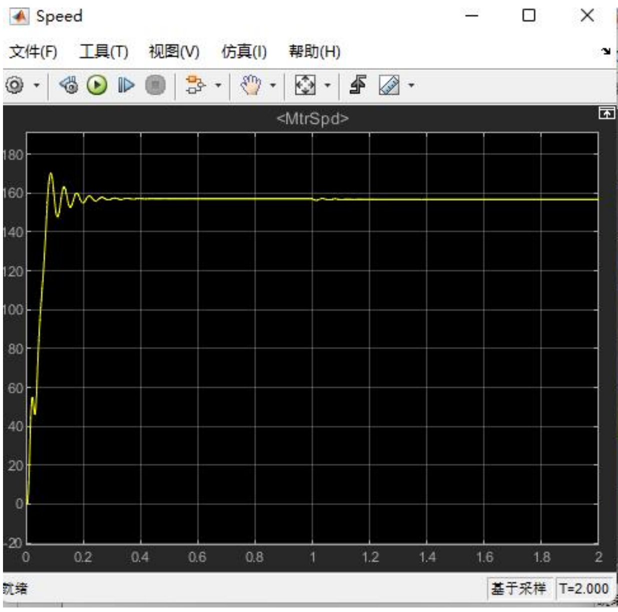
$$P' = P * 2 = 4$$

$$ns = 120 * \frac{f}{P'} = 120 * 100 * \frac{pi}{4} = 157(\text{rad/s})$$

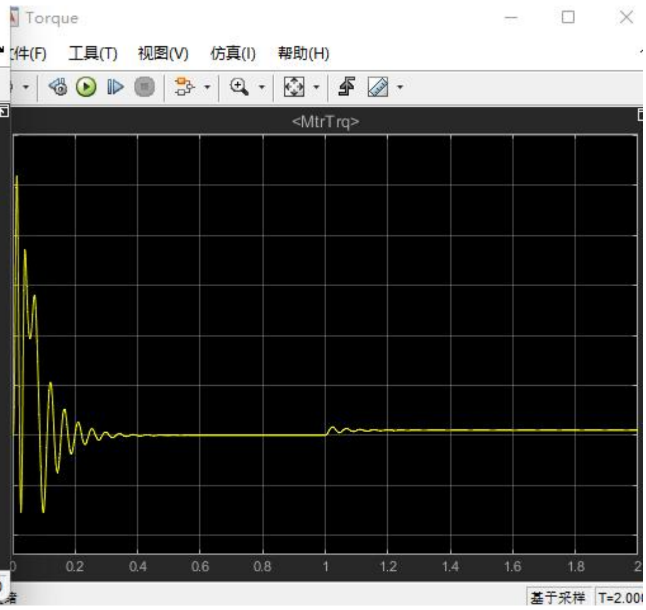
The calculated value is 157 and it is near the value of steady-state speed in the graph.

5.Change the moment of inertia (put it down its value) and show firgures of speed, torque, stator's currents

Speed of the motor:



Torque of the motor:



Current of the motor:

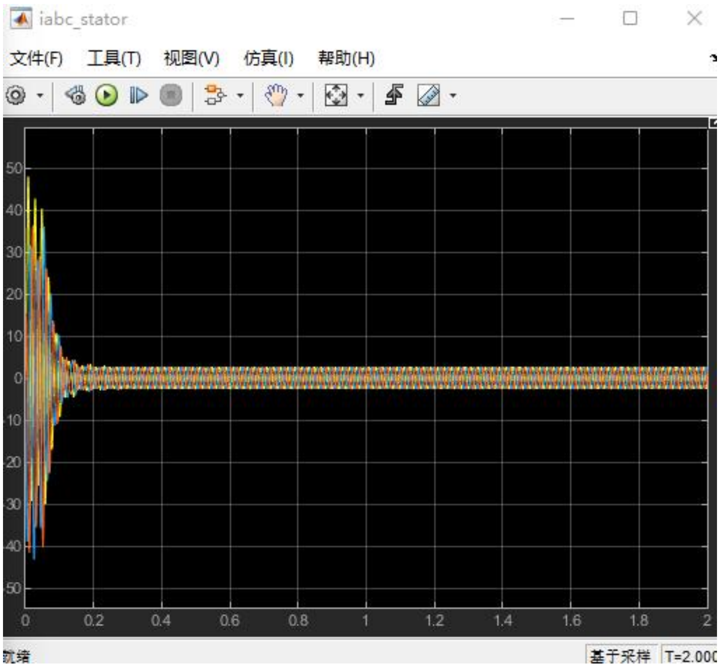
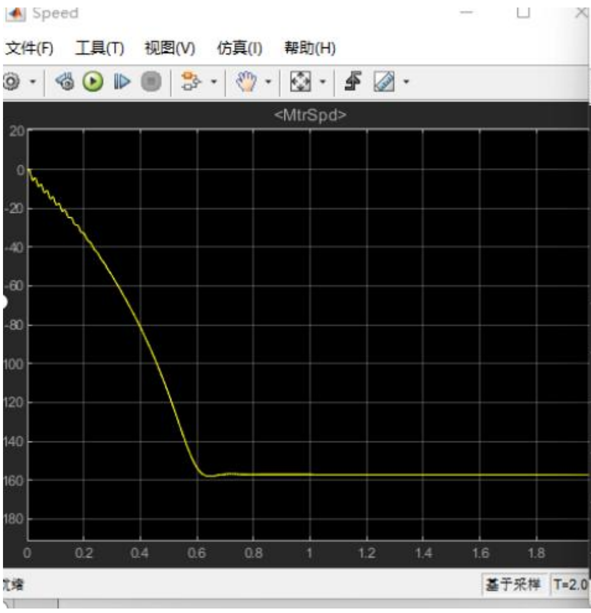


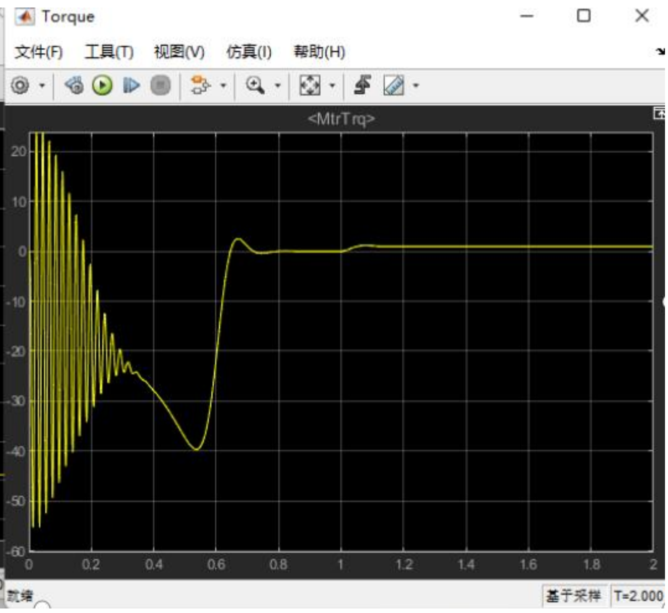
Figure 5. Motor with small moment of inertia: motor transients (speed, torque, currents) when connected to a three-phase power supply (moment of inertia J=0.01)

6. Change the direction of speed (change the direction of speed (this can be done by swapping any two source terminals)

Speed of the motor:



Torque of the motor:



Current of the motor:

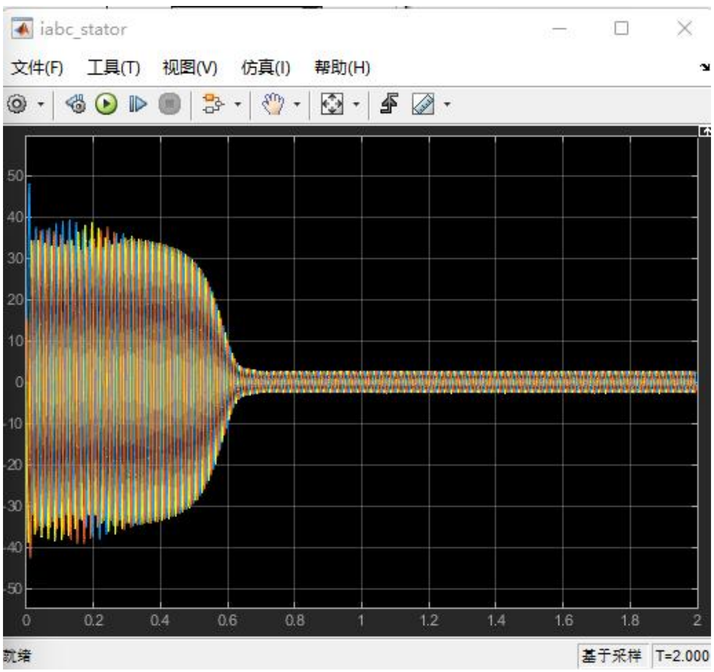


Figure 6. Motor with different direction of speed: motor transients (speed, torque, currents) when connected to a three-phase power supply (swap Ua and Ub)

7. Simulate start of the motor and shown firgures of speed-to-torque curve using XY-graph (*firgure 7* in report)

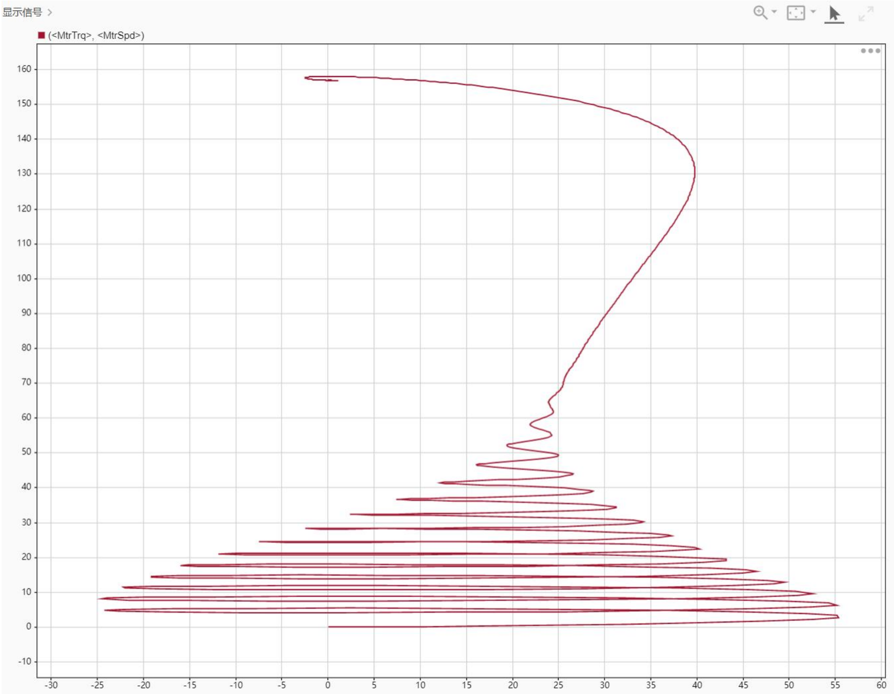
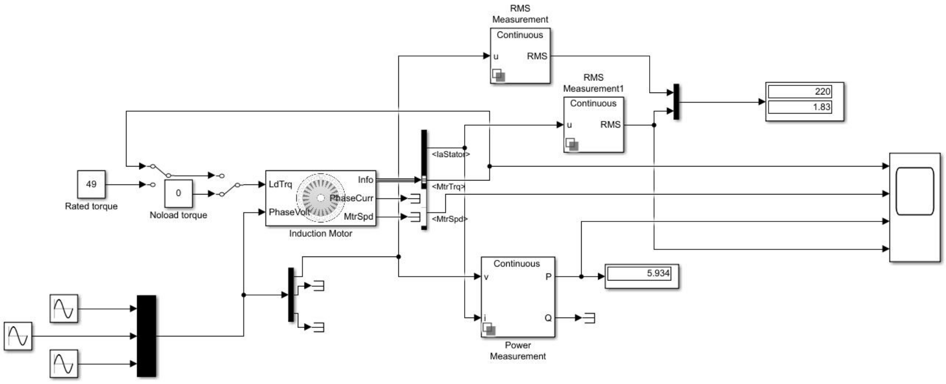


Figure 7. Start motor: XY-graph of speed-to-torque curve (moment of inertia J=0.095)

Task2

1. No-load test:0



Calculation:

$$In := 1.83$$

$$Pn := 5.934$$

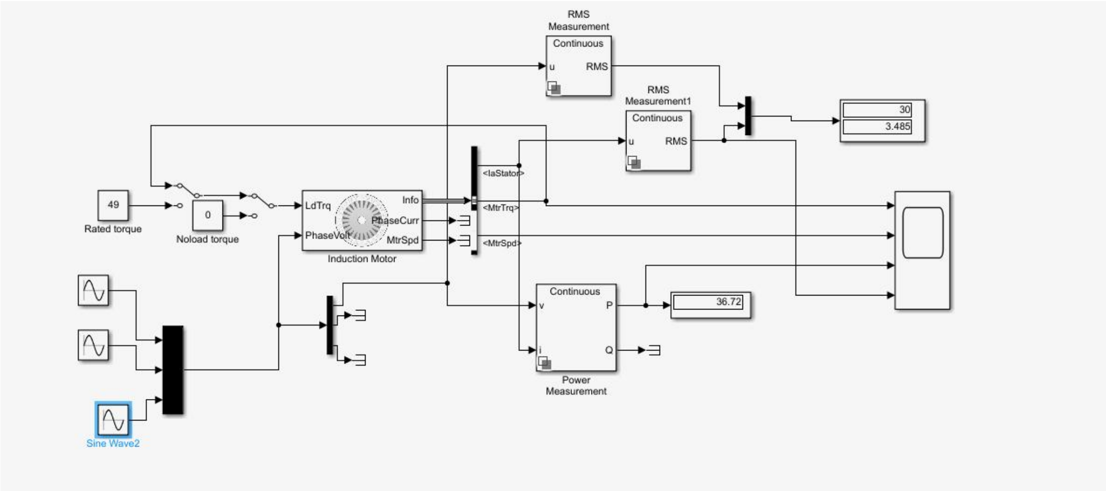
$$Un := 220$$

$$Zn := \frac{Un}{In} = 120.2186$$

$$Rs := \frac{Pn}{In^2} = 1.7719$$

$$Xn := \sqrt{Zn^2 - Rs^2} = 120.2055$$

2. Blocked rotor test



Calculation:

$$Ib := 3.484$$
$$Ub := 30$$
$$Pb := 36.73$$

$$Rr := \frac{Pb}{Ib^2} - Rs = 1.254$$

$$Zb := \frac{Ub}{Ib} = 8.6108$$

$$Xb := \sqrt{Zb^2 - (Rs + Rr)^2} = 8.0616$$

$$Xls := 0.5 \cdot Xb = 4.0308$$
$$Xlr := 0.5 \cdot Xb = 4.0308$$

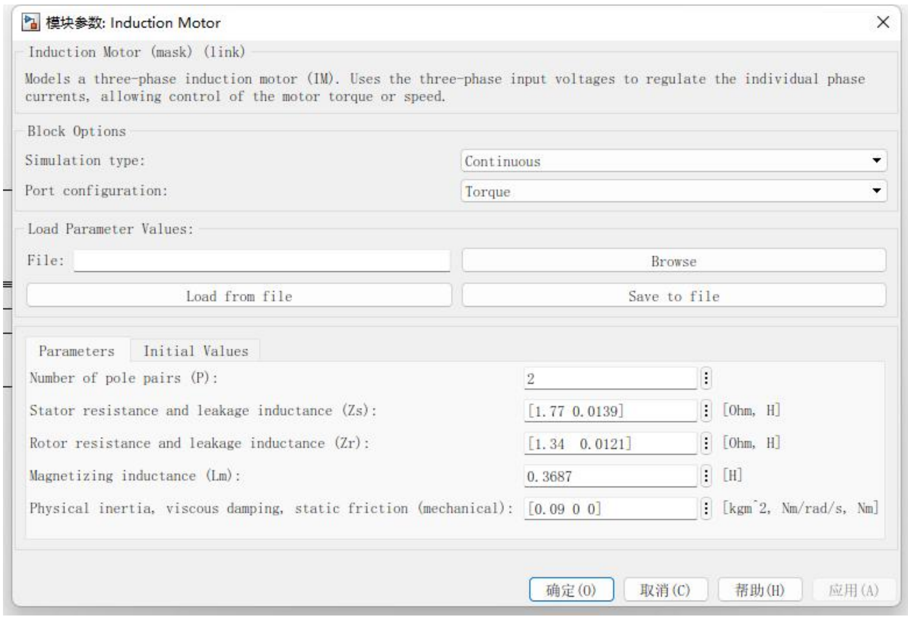
$$Xm := Xn - Xls = 116.1747$$

$$Lls := \frac{Xls}{2 \cdot \pi \cdot 50} = 0.0128$$

$$Llr := \frac{Xls}{2 \cdot \pi \cdot 50} = 0.0128$$

$$Lm := \frac{Xm}{2 \cdot \pi \cdot 50} = 0.3698$$

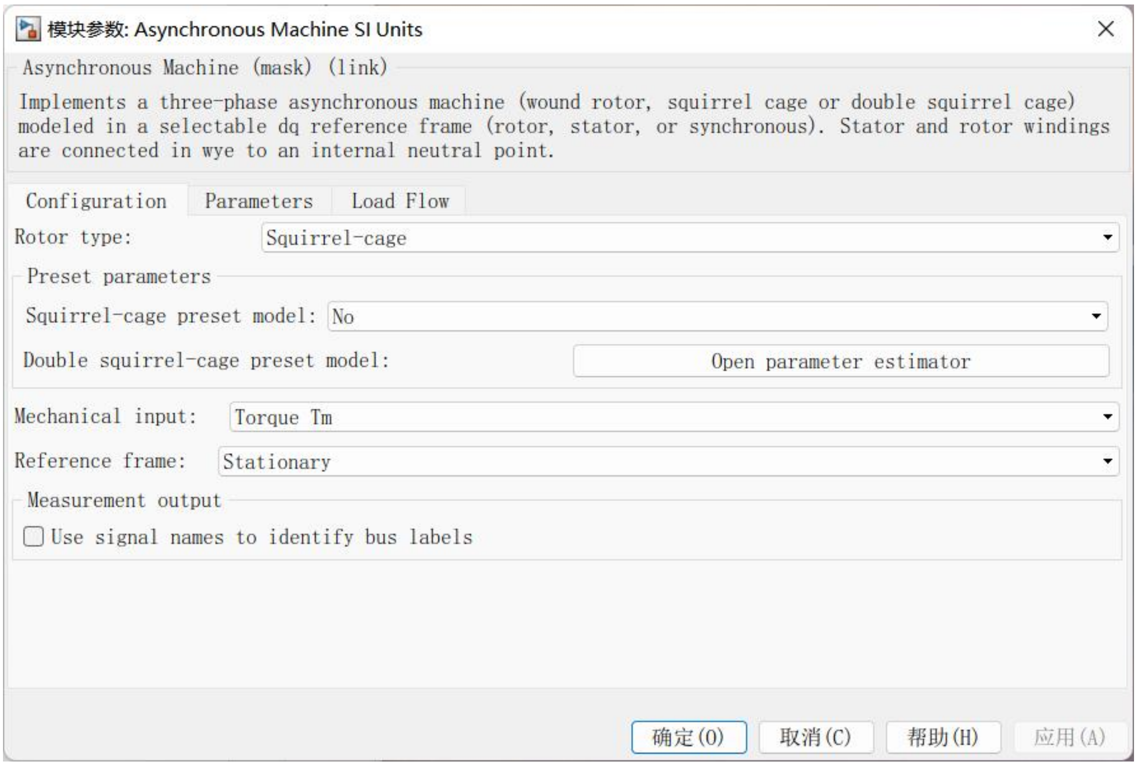
3. Block Induction Motor



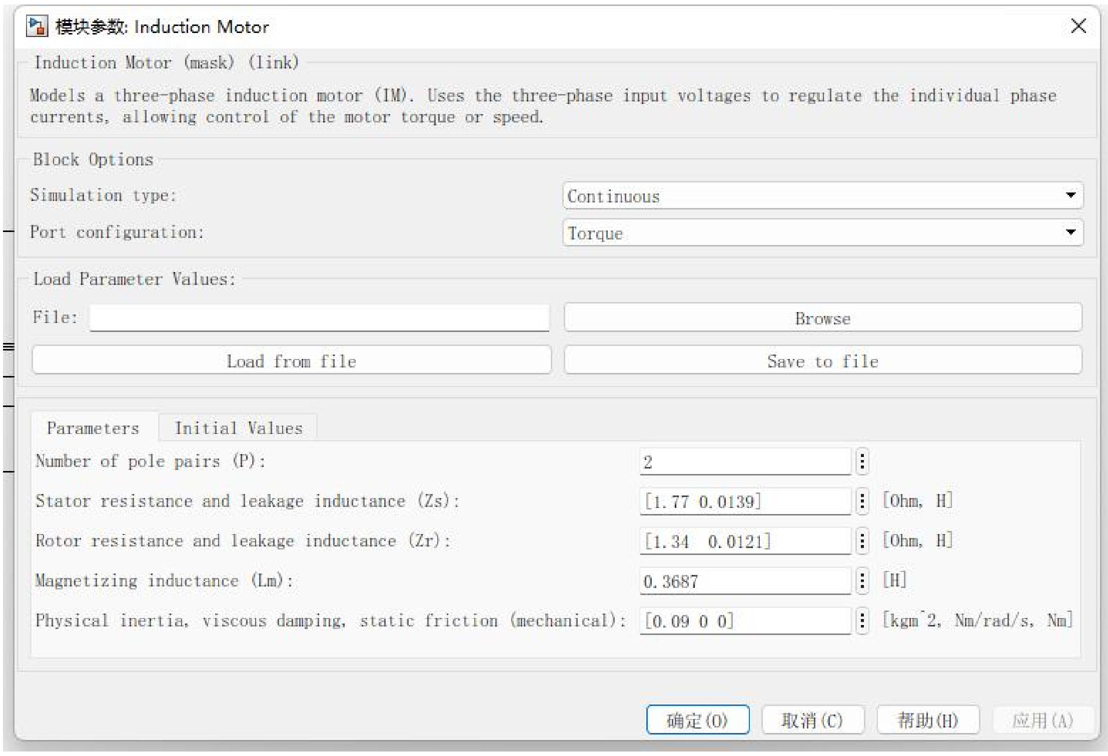
4.Conclusion:

The task involved evaluating the performance of an induction motor through simulation. By applying load torque and phase voltage, the model produced outputs like phase current and motor speed, enabling comparison between loaded and no-load states. RMS measurement blocks provided data on input voltage and current stability, while the power measurement block allowed for analyzing real and reactive power, helping to calculate motor efficiency and power factor. The system's display monitored key parameters, facilitating the assessment of the motor's performance against design goals.

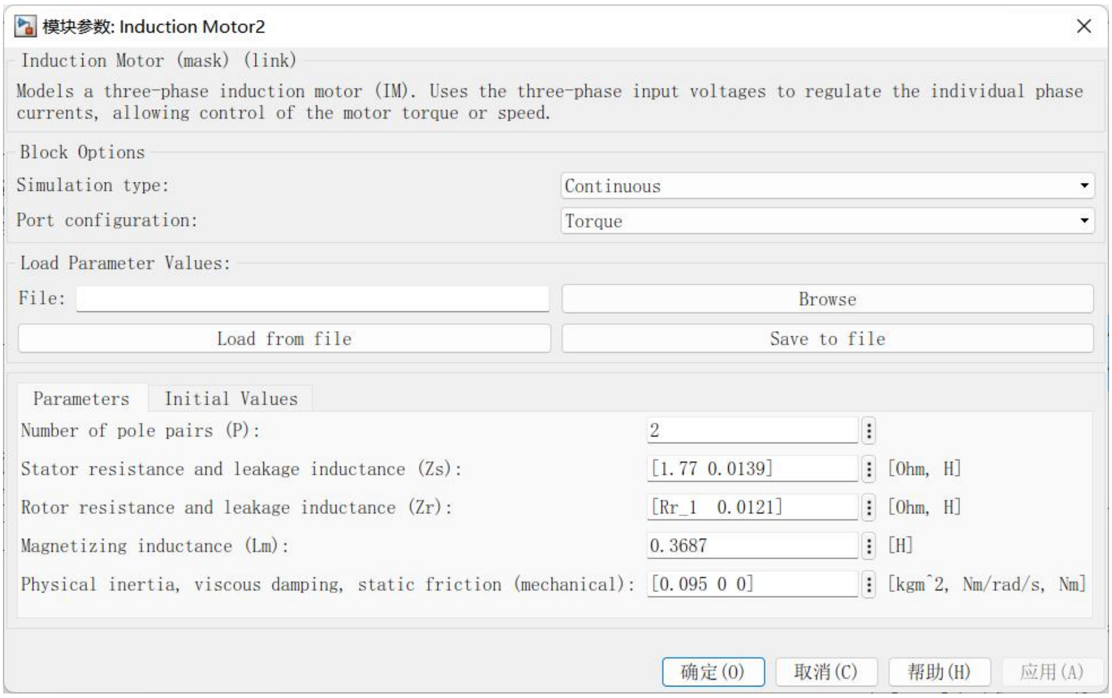
Part3:



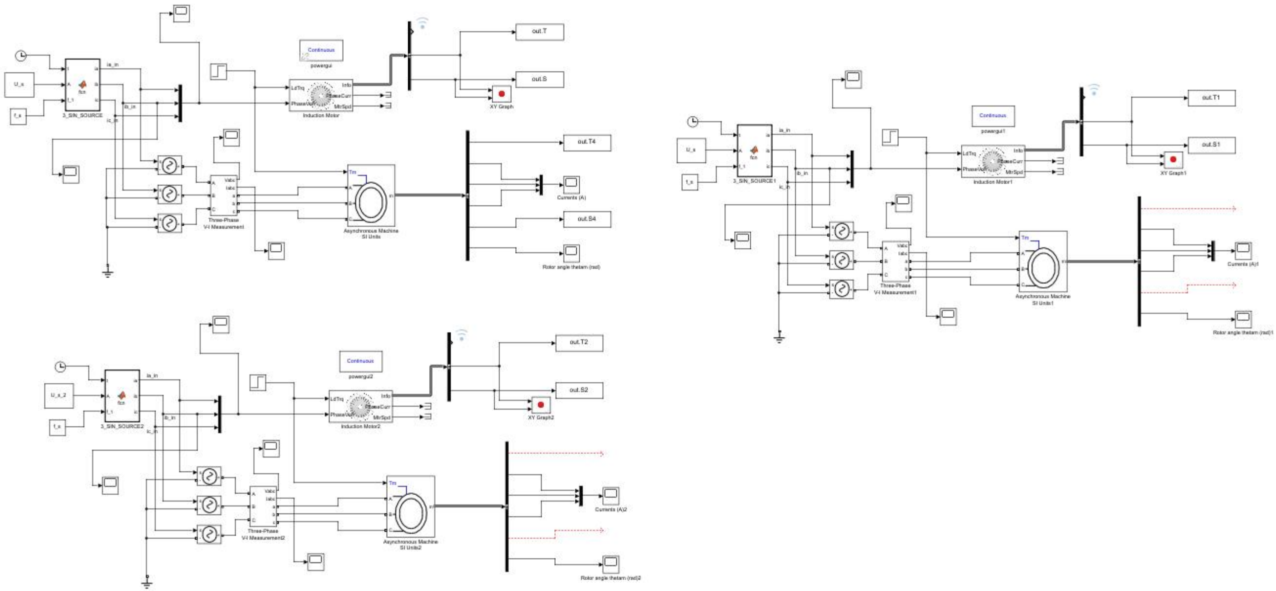
Paramenters of Asynchronous Machine SI Units



Paramenters of Induction Motor (J=0.09)



Paramenters of Induction Motor (Rr=1.50)



```
U_s = 220*sqrt(2);
f_s = 50;
Rr_1 = 1.50;
U_s_2 = 150*sqrt(2);

plot(out.T,out.S,out.T4,out.S4,out.T1,out.S1,out.T2,out.S2)
legend;
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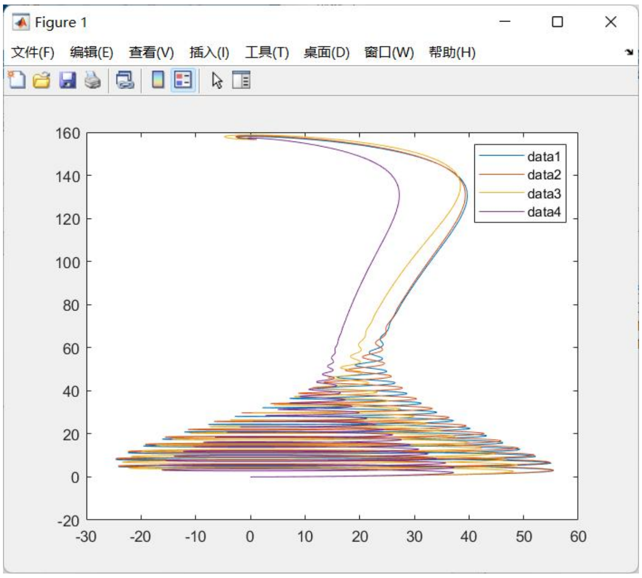

Conclusion:

I learned how to evaluate the performance of an induction motor by conducting a no-load test and a blocked rotor test using a Simulink model. These tests allowed me to determine key parameters for the motor's equivalent circuit, such as stator resistance and reactance. By analyzing the motor's dynamic behavior, I was able to compare it with its design specifications and assess its efficiency under different conditions.