

Simulation Study on Mechanical Properties of Three-phase Asynchronous Motor Based on Mixed Programming

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Abstract—Studies on mechanical properties of three-phase asynchronous motor, we usually use Matlab to establish a model to achieve the simulation of the motor mechanical properties. In the process of the actual use, modify large number of parameters will cause many program errors and affect the experimental velocity. By the mixed programming of MATLAB and VB, we can use the feature of visualization interface of VB and the feature of software toolboxes and the function of drawing of Matlab. Combining Characteristics of VB and Matlab and using mixed programming of VB and Matlab to achieve simulation are useful attempts.

Keywords-three-phase asynchronous motor; mechanical properties; visual basic; matlab program.

I. INTRODUCTION

Recent years, DC motors have been replaced by asynchronous motors gradually, asynchronous motors are becoming the most important power device in electric drive field[1]. Against The problems that Matlab computing speed is slow in research and analysis applications in the mechanical properties of the motor. This method of mixed programming improved running speed. In this paper, through the analysis of mechanical properties of three-phase asynchronous motor, focuses on adopting COM(Component Object Model) generator to combine Matlab and VB to study the mechanical properties of three-phase asynchronous motor, which is proved to be more convenient and efficient.

II. MECHANICAL PROPERTIES OF THREE-PHASE ASYNCHRONOUS MOTOR

Under the condition of rated frequency and rated supply voltage, the relationship between electromagnetic torque and speed of three-phase asynchronous motor is called mechanical properties[1]. Artificial mechanical properties refers to artificially change the stator voltage, magnetic pole logarithm, working frequency to obtain the mechanical properties[4]. The relationship between electromagnetic torque and slip of three-phase asynchronous motor is:

$$Te = \frac{m_p U_1^2 R_2'}{2\pi f_1 [(R_1 + \frac{R_2}{s}) + (X_{1\sigma} + X_{2\sigma})^2]} \quad (1)$$

In the above formula: m_p and f_1 is on behalf of the number of phase and frequency of the power supply respectively; P is the magnetic poles number; U_1 is the phase voltage of stator winding;

s is the slip ratio; R_1 is the resistance of stator winding; $X_{1\sigma}$ is the leakage reactance of stator winding; R_2' is the converted resistance of stator winding; $X_{2\sigma}'$ is the converted leakage reactance of stator winding.

III. IMPLEMENTATION METHOD OF MIXED PROGRAMMING OF MATLAB AND VB

There are several methods to realize the mixed programming of Matlab and VB, this paper focuses on the activex components based on COM.

Introduction to COM: as an open component, COM has a very strong capacity of expansion [2]. Using ActiveX automation interface in the VB, Matlab can be called by VB as an ActiveX component. Type in “mbuild-setup” in Matlab , select the compiler of Matlab and the other compiler in the machine. After configuration is completed, Matlab can be connected to C++[3].

Use Matlab to create COM component. The exact process is as follows. First, use Matlab to create a M program. Second, type in “comtool” instruction to call out the main window of Matlab COM Build, which is necessarily needed for creating a COM component; select the file option, type in the name of new component and the class name, add the M program to the new project; click “build” button, after the compilation is done, the M program is converted to COM component. Third, use VB to call-out the DLL program in the COM component created by Matlab.

IV. THE EXAMPLE OF MIXED PROGRAMMING OF MATLAB AND VB

A. Create the M program

The following M program is required for this paper.

```
Function [s,Tmech]=s-T (Un, Nphase, P, fN, R1, X1, X2, Xm)
omegas=2*pi*fN/P;
nS=60*fN/P;
for m=1:5
if m==1
R2=0.1;
else if m==2
R2=0.2;
else if m==3
R2=0.5;
else if m==4
R2=1.0;
else
R2=1.5;
end
for n=1:2000
s(n)=n/2000;
```

```

Tmech=Nphase*P*U1*2*R2/s(n)/omegas/[(Rl+R2/s(n))^2+(X1+X2)^2];
plot (s(n),Tmech)
end
if m==1
hold
end
end
end
hold
xlabel('Slip Ratio')
ylabel('Electromagnetic Torque ')
title('Mechanical characteristic for asynchronous motor with different rotor resistances')
disp('End')

```

B. Create the VB program

The window of VB and the control property table are shown as follows:

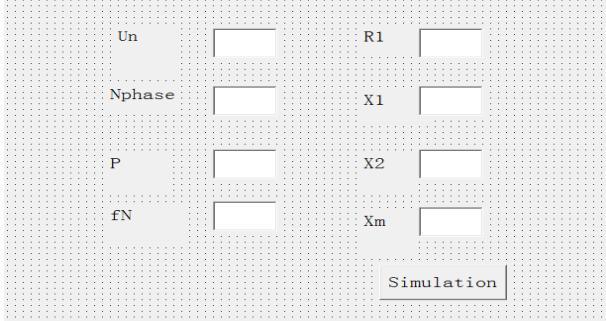


Figure 1. The window of VB

TABLE I. CONTROL PROPERTY TABLE

The control type and name	the corresponding input	The control type and name	Control property
Text1	.Text="”Un”	Label1	.Caption="”Un”
Text2	.Text="”Nphase”	Label2	.Caption="”Nphase”
Text3	.Text="”P”	Label3	.Caption="”P”
Text4	.Text="”fN”	Label4	.Caption="”Fn”
Text5	.Text="”R ₁ ”	Label5	.Caption="”R ₁ ”
Text6	.Text="”X ₁ ”	Label6	.Caption="”X ₁ ”
Text7	.Text="”X ₂ ”	Label7	.Caption="”X ₂ ”
Text8	.Text="”X _m ”	Label8	.Caption="”X _m ”
		Command button	.Caption="”Simulation”

C. Simulation result

Type in the parameters, the result is shown as follow:

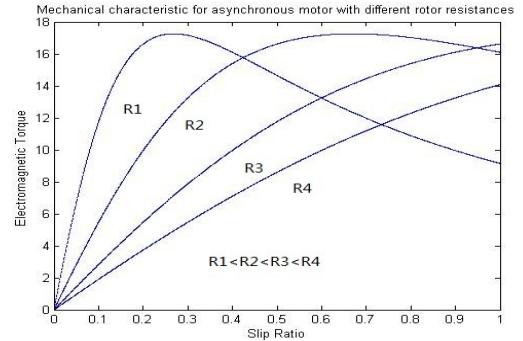


Figure 2.The result of mixed programming

D. Modify the parameters

TABLE II.CHANGE THE SUPPLY VOLTAGE

U _n	Nphase	P	fN	R1	X1	X2	X _m
220	3	2	50	0.095	0.680	0.672	18.7

The result of changing supply voltage is shown as follow:

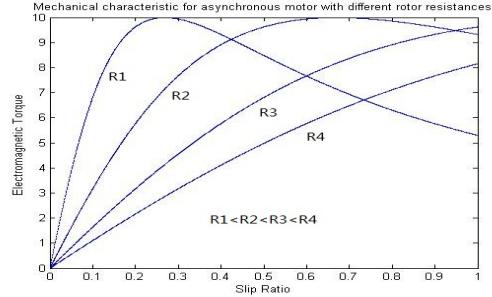


Figure 3.The result of changing supply voltage

V.CONCLUSION

Using the mixed programming is more efficient and accurate. By the mixed programming of MATLAB and VB, we can combine the advantages of Matlab and VB, accelerate the speed of simulation. Modify the parameters on the concise interface of VB, which can avoid mistakes and save time. It is proved that using mixed programming is more convenient and more quick.

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