

Scilab Textbook Companion for
Electric Drives Concepts And Applications
by Vedam Subrahmanyam¹

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Book Description

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

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Chapter 1

Characteristics of Electric motor

Scilab code Exa 1.1 Find the speed of the motor

```
1 // Electric Drives concepts and application by V.
   Subrahmanyam
2 // Publisher : Tata McGraw-Hill
3 // Edition : Second
4 // Ex1-1
5 clc;
6 clear;
7 V=500; // voltage v
8 N1=900; // speed in rpm
9 Ia1=45; //armature current in A
10 Ia2=21; //armature current in A
11 R=8; // resistance in ohm
12 Ra=1; //armature resistance in ohm
13 Eb1=V-(Ia1*Ra);
14 Eb2=V-(9*Ia2);
15 N2=N1*(Eb2/Eb1);
16 disp(N2, 'New speed in rpm is :');
```

```
Scilab 5.5.2 Console
New speed in rpm is :
    615.16484
-->
```

Figure 1.1: Find the speed of the motor

```
Scilab 5.5.2 Console ? ↗ ✕

The initial breaking torque in Nm is:

6.9304445

-->
```

Figure 1.2: Calculate the initial breaking torque

Scilab code Exa 1.2 Calculate the initial breaking torque

```
1 // Electric Drives: concepts and application by V.
  Subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex1_2
5 clc;
6 clear;
7 V1=400; //supply voltage is V
8 I1=70; //Current in A
```

```

 9 N1=78.5; //speed in rad/sec
10 R1=0.3; //resistance in ohm
11 I2=90; //current in A
12 N2=31.4; //Speed in rpm
13 Eb1=V1-(I1*R1);
14 T1=(Eb1*I1)/N1;
15 V2=V1+Eb1;
16 R2=(V2/I2)-R1;
17 T2=(Eb1*I2)/N1;
18 Eb2=(Eb1*N2)/N1;
19 I=(V1+Eb2)/R2;
20 T=(Eb2+I)/N2;
21 disp(T, 'The initial breaking torque in Nm is:')
22 //Calculation error in the textbook

```

Scilab code Exa 1.3 Find the resistance needed to reduce the speed

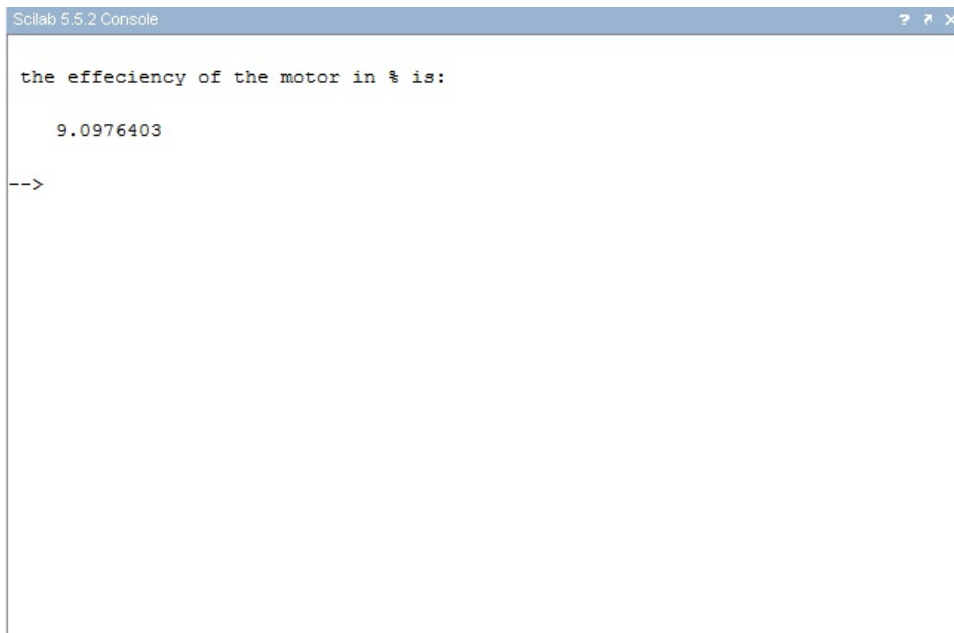
```

1 //Electric drives concepts and application by V.
  Subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_3
5 clc;
6 clear;
7 V=250; //supply voltage V
8 Ia1=40; //Armature current in A
9 R1=0.6; //Resistance in ohm
10 N1=2.828; //speed in rpm
11 N2=2; //speed in rpm
12 Ia2=((Ia1)^2/N1)^(1/2);
13 Eb1=V-(Ia1*R1);
14 Eb=(Ia1/Ia2)*N2;
15 Eb2=Eb1/Eb;

```

```
Scilab 5.5.2 Console ? ↗ ✕  
  
External resistance required in ohm:  
  
7.6854115  
-->|
```

Figure 1.3: Find the resistance needed to reduce the speed



```
Scilab 5.5.2 Console

the effeciency of the motor in % is:

  9.0976403

-->
```

Figure 1.4: Calculate the efficiency

```
16 R2=(V-Eb2)/Ia2;
17 disp(R2,'External resistance required in ohm:')
```

Scilab code Exa 1.4.a Calculate the efficiency

```
1 //Electric Drives:concepts and applications by V.
  subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_4a
5 clc;
6 clear;
7 V=440;// voltage in V
8 Ia=80;// Current in A
```

```

 9 Na=1200; //Speed in rpm
10 Na1=125.6; // Speed in rad/sec
11 R1=0.55; // Resistance in ohm
12 R2=110; // Resistance in ohm
13 N0=600; // Speed in rpm
14 N01=62.8; //Speed in rpm
15 Nf=300; // Speed in rpm
16 Nf1=31.4; // Speed in rpm
17 Rsh=1.256; // Resistance in ohm
18 E=V-(Ia*R1);
19 K=E/Na1;
20 E1=K*N01;
21 Tf=K*Ia;
22 E2=E1*(Nf/N0);
23 V2=E2+(Ia*R1);
24 Is=(V2/Rsh)+Ia;
25 I1=Is+(V/R2);
26 Pi=V*I1;
27 Po=Tf*Nf1;
28 Eff=(Po/Pi)*100;
29 disp(Eff, 'the effeciency of the motor in % is:')

```

Scilab code Exa 1.4.b Calculate the no load and full load speeds

```

1 //Electric Drives:concepts and applications by V.
  subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_4b
5 clc;
6 clear;
7 V=440; //voltage in V
8 K=3.153;

```

```
Scilab 5.5.2 Console

No load speed in rpm is:

    999.45064

Full load speed in rpm is:

    230.17651

-->
```

Figure 1.5: Calculate the no load and full load speeds

```
9 Ia=80; // Current in A
10 Rs=2; // Resistance in ohm
11 Rsh=1.5; // Resistance in ohm
12 R1=0.55; // Resistance in ohm
13 Alpha=(Rs/Rsh);
14 Vo=(V/Alpha);
15 No=(Vo/K);
16 N=((60*No)/(2*pi));
17 disp(N, 'No load speed in rpm is:')
18 V2=((V/Rs)-Ia)/((1/Rs)+(1/Rsh));
19 E2=V2-(Ia*R1);
20 N2=N*(E2/Vo);
21 disp(N2, 'Full load speed in rpm is:')
```

```
Scilab 5.5.2 Console ? ? X

The speed of the motor in rpm is:

    898.56

The torque developed in Nm is:

    99.471839

-->
```

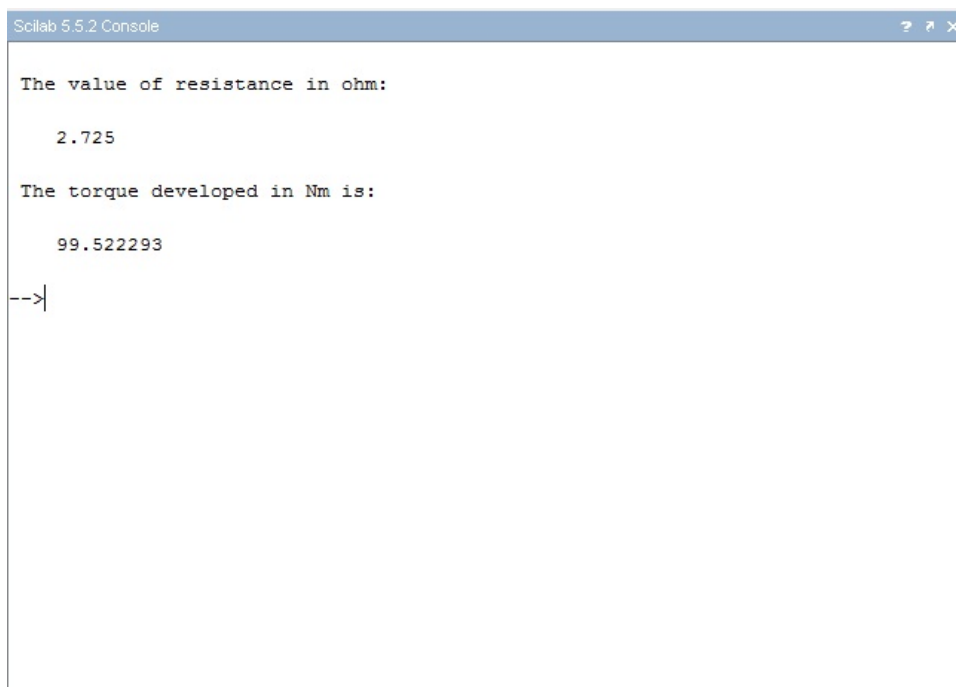
Figure 1.6: Determine the speed and torque developed

Scilab code Exa 1.5.a Determine the speed and torque developed

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex1_5a
5 clc;
6 clear;
7 V=250; // voltage in V
8 Ra=0.4; // Resistance in ohm
9 Na=480; // Speed in rpm
10 Va=125; // voltage in V
11 Ia=40; // Current in A
12 Vi=V-(Ra*Ia);
13 N=Na*(Vi/Va);
14 disp(N, 'The speed of the motor in rpm is:')
15 N1=(2*pi*N)/60;
16 T=(Vi*Ia)/N1;
17 disp(T, 'The torque developed in Nm is:')
```

Scilab code Exa 1.5.b Determine the resistance and torque developed

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex1_5b
5 clc;
6 clear;
7 V=250; // voltage in V
8 I=40; // Current in A
9 Ra=0.4; // Resistance in ohm
```



```
Scilab 5.5.2 Console
The value of resistance in ohm:
2.725
The torque developed in Nm is:
99.522293
-->
```

Figure 1.7: Determine the resistance and torque developed

```
Scilab 5.5.2 Console ? ? x

The speed of motor in rpm is:

480.76312

The torque in Nm is:

3.8246004

-->
```

Figure 1.8: Determine the speed and torque of the motor

```
10 Eb=125; // voltage in V
11 Na=50.24; //Speed in rpm
12 Re=(V-Eb-(I*Ra))/I;
13 disp(Re, 'The value of resistance in ohm:')
14 T=(Eb*I)/Na;
15 disp(T, 'The torque developed in Nm is:')
16 //Result vary due to error in calculation of torque
    in the textbook
```

Scilab code Exa 1.6 Determine the speed and torque of the motor

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_6
5 clc;
6 clear;
7 V=250;// voltage in V
8 I=40;//Current in A
9 R1=2.725;// Resistance in ohm
10 R2=3.5;// Resistance in ohm
11 Rf=0.15;// Resistance in ohm
12 N=480;//Speed in rpm
13 V1=V-I*(R1+Rf);
14 Ir=(V1/R2);
15 Ia=I-Ir;
16 Eb=V1-(Ia*Rf);
17 Nm=N*(V1/Eb);
18 disp(Nm,'The speed of motor in rpm is:')
19 //Result vary due to 125V is used instead of 135V in
    the textbook
20 T=(Eb*Ia)/(2*%pi*Nm/60);
21 disp(T,'The torque in Nm is:')

```

Scilab code Exa 1.7 Determine the speed and torque of the motor

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_7
5 clc;
6 clear;

```

```
Scilab 5.5.2 Console ? ↶ ✕  
  
The speed of the motor in rpm is:  
  
    242.9841  
  
The torque in Nm is:  
  
    99.471839  
  
-->
```

Figure 1.9: Determine the speed and torque of the motor

```

7 V=250; // voltage in V
8 I=40; //Current in A
9 Ro=0.4; // Resistance in ohm
10 R1=2.725; // Resistance in ohm
11 R2=3.5; // Resistance in ohm
12 Eb=125; // voltage in V
13 Na=480; //Speed in rpm
14 Na1=50.24; //Speed in rad/sec
15 R=((1/R1)+(1/R2));
16 Vm=(V-(I*R1))/(R*R1);
17 Em=Vm-(I*Ro);
18 N=(Em/Eb)*Na;
19 disp(N, 'The speed of the motor in rpm is:')
20 N1=(2*pi*N)/60;
21 I1=(V-Vm)/R1;
22 Po=Em*I;
23 T=Po/N1;
24 disp(T, 'The torque in Nm is:')

```

Scilab code Exa 1.8 Determine the speed and torque of the motor

```

1 //Electric Drives:concepts and applications by V.
   subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_8
5 clc;
6 clear;
7 V=250; // voltage in V
8 I=40; //Current in A
9 R1=0.91; // Resistance in ohm
10 Rs=0.95; // Resistance in ohm
11 Eb=125; // voltage in V

```

```
Scilab 5.5.2 Console ? ? X

The speed in rpm is:

- 84.7104

The torque in Nm is:

- 164.12854

-->
```

Figure 1.10: Determine the speed and torque of the motor


```
Scilab 5.5.2 Console

Direct on line starting torque in Nm is:

    2.56

By Star/delta starter:

    0.8533333

-->
```

Figure 1.11: Compute direct on line starting torque and by a star delta starter

```
12 N1=480; //Speed in rpm
13 Vm=Rs*I;
14 Ia=I-((V-Vm)/2);
15 Em=-Vm-(Ia*R1);
16 N=-(Em/Eb)*N1;
17 disp(N, 'The speed in rpm is:')
18 N2=-(2*pi*N)/60;
19 T=(Em*Ia)/N2;
20 disp(T, 'The torque in Nm is:')
```

Scilab code Exa 1.10 Compute direct on line starting torque and by a star delta st

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_10
5 clc;
6 clear;
7 Sf=0.04;//Full load slip in %
8 Ist=1;//Starting current in A
9 If1=Ist/8;
10 T=(8)^2*Sf;
11 disp(T,"Direct on line starting torque in Nm is:")
12 S=T/3;
13 disp(S,"By Star/delta starter:")

```

Scilab code Exa 1.11 Determine the torque

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex1_11
5 clc;
6 clear;
7 Sf1=0.04;//Full load slip in %
8 x=(8*3)^(1/2);
9 Tst=(x)^2*Sf1;
10 S=Sf1/2;
11 T=(8)^2*S;
12 disp(T,"Torque in Nm is:")

```

```
Scilab 5.5.2 Console ? ? x
Torque in Nm is:
    1.28
-->
```

Figure 1.12: Determine the torque

```
Scilab 5.5.2 Console ? ↗ ✕  
  
Torque in Nm is:  
  
    0.16  
  
-->
```

Figure 1.13: Determine the torque

Scilab code Exa 1.12 Determine the torque

```
1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex1_12
5 clc;
6 clear;
7 Sf=0.04; // Full load slip in %
8 I=5; // Current in A
9 Tst=(I)^2*Sf;
10 x=((2/I)*100)^(1/2);
11 T=(2/I)^2*(I)^2*Sf;
12 disp(T, "Torque in Nm is:")
```

Scilab code Exa 1.13 Compute the impedance of motor and the breaking torque

```
1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex1_13
5 clc;
6 clear;
7 V=500; // Voltage in V
8 r1=0.13; // resistance in ohm
9 r2=0.32; // resistance in ohm
10 x1=0.6*i; // reactance in ohm
11 x2=1.48*i; // reactance in ohm
```

```
Scilab 5.5.2 Console ? ? X

The impedance of motor is:

    6.53 + 2.08i

The impedance at plugging is:

    1.0675 + 2.08i

The braking torque in Nm is:

    77019.173

-->
```

Figure 1.14: Compute the impedance of motor and the breaking torque

```
12 rm=250; //resistance in ohm
13 xm=20; //reactance in ohm
14 S=0.05; //Full load slip in %
15 Z2=r1+x1+(r2/S)+x2;
16 disp(Z2,"The impedance of motor is:")
17 I2=(V/(sqrt(3)*(6.853)));
18 T1=3*(I2)^2*(r2/S);
19 Sb=2-S;
20 Sf=2-S+r1;
21 Zb=r1+x1+(Sb/Sf)+x2;
22 disp(Zb,"The impedance at plugging is:")
23 I=(V/(sqrt(3)*(2.336)));
24 T2=3*(I)^2*(Sb/Sf);
25 T=T1+T2;
26 disp(T,"The braking torque in Nm is:")
```

Chapter 3

Converters for Feeding Electric Motors

Scilab code Exa 3.1 Determine the current in the load

```
1 //Electric Drives:concepts and applications by V.
   subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_1
5 clc;
6 clear;
7 Rd=2;//Resistance in ohm
8 Eb=150;//Back emf in V
9 Vs=400;//Supply voltage in V
10 Alpha=0.52;//angle in radian
11 Vdia=((2*sqrt(2)*Vs*cos(Alpha))/%pi);
12 Id=(Vdia-Eb)/Rd;
13 Irms=Id/sqrt(2);
14 disp(Id,"Current in the load in A is:")
```

```
Scilab 5.5.2 Console ? ? X
Current in the load in A is:
81.262353
-->
```

Figure 3.1: Determine the current in the load



The firing angle in degree is:
88.128663
-->

Figure 3.2: Determine the firing angle of the converter

Scilab code Exa 3.2 Determine the firing angle of the converter

```
1 // Electric Drives: concepts and applications by V.  
  subrahmanyam  
2 // Publisher: Tata McGraw-Hill  
3 // Edition: Second  
4 // Ex3_2  
5 clc;  
6 clear;  
7 Vs=400; // Supply voltage in V  
8 Id=80.88; // Current in A
```

```
Scilab 5.5.2 Console ? ↗ ✕

The overlap angle in deg is:

    5.1916304

-->
```

Figure 3.3: Determine the overlap angle

```
9 Rd=2; // Resistance in ohm
10 Eb=-150; // Back emf in V
11 Vdia=Id*Rd+Eb;
12 a=acos((Vdia*%pi)/(2*sqrt(2)*Vs));
13 Alpha=(a*180)/%pi;
14 disp(Alpha,"The firing angle in degree is:")
```

Scilab code Exa 3.3 Determine the overlap angle

```
1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher: Tata McGraw-Hill
```

```

3 //Edition:Second
4 //Ex3_3
5 clc;
6 clear;
7 Id=80.88;//Current in A
8 Rd=2;//Resistance in ohm
9 Xc=0.628;//Reactance in ohm
10 Vs=400;//Supply voltage in V
11 Eb=150;//Back emf in V
12 Z=Id*(Rd+(Xc/%pi));
13 a=acos((Z-Eb)/(0.9*Vs));
14 Alpha=(a*180)/%pi;
15 c=cos(Alpha);
16 d=-c/11;
17 b=(Id*Xc*2)/(%pi*Vs);
18 X=d-b;
19 e=acos(X);
20 f=(e*180)/%pi;
21 u=f-Alpha;
22 disp(u,"The overlap angle in deg is:")

```

Scilab code Exa 3.4 Determine the average value of converter voltage and current a

```

1 //Electric Drives:concepts and applications by V.
   subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_4
5 clc;
6 clear;
7 Vs=200;//Supply voltage in V
8 Rd=12.5;//Resistance in ohm
9 Xc=0.5;//Reactance in ohm

```

```
Scilab 5.5.2 Console ? ↗ ✕

The average value of dc current in A is:

7.1094793

The average value of converter voltage in V is:

88.868491

The overlap angle in deg is:

0.7458187

-->
```

Figure 3.4: Determine the average value of converter voltage and current and overlap angle

```

10 pf=0.5; // Powerfactor
11 Vdia=0.9*Vs*pf;
12 Id=Vdia/(Rd+(Xc/%pi));
13 disp(Id,"The average value of dc current in A is:")
14 Vd=Id*Rd;
15 disp(Vd,"The average value of converter voltage in V
    is:")
16 Vc=Vdia-Vd;
17 X=pf-((Vc*2)/Vs);
18 c=acos(X);
19 d=(c*180)/%pi;
20 u=d-60;
21 disp(u,"The overlap angle in deg is:")
22 //Result vary due to error in calculation of overlap
    angle in the textbook

```

Scilab code Exa 3.5 Determine the average value of load current and overlap angle

```

1 // Electric Drives: concepts and applications by V.
    subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex3_5
5 clc;
6 clear;
7 f=50; // Frequency in Hz
8 Rd=2.5; // Resistance in ohm
9 Lc=0.005; // Inductance in mH
10 Vs=220; // Supply voltage in V
11 pf=1; // Powerfactor
12 pf1=0.866; // Powerfactor
13 Xc=2*%pi*f*Lc;
14 Z=Rd+((2*Xc)/%pi);

```

```
Scilab 5.5.2 Console ? ↗ ✕

The average value of load current in A is:

    56.571429

The overlap angle u in deg is:

    64.623066

The overlap angle u1 in deg is:

    35.125722

-->|
```

Figure 3.5: Determine the average value of load current and overlap angle

```

15 Vdia=0.9*Vs*pf;
16 Id=Vdia/Z;
17 disp(Id,"The average value of load current in A is:")
    )
18 Vd=Id*Rd;
19 Vdc=Vdia-Vd;
20 a=(1-((Vdc*2)/Vdia));
21 b=acos(a);
22 u=(b*180)/%pi;
23 disp(u,"The overlap angle u in deg is:")
24 Vdia1=0.9*Vs*pf1;
25 Id1=Vdia1/Z;
26 Vd1=Id1*Rd;
27 Vdc1=Vdia1-Vd1;
28 V=pf1-((Vdc1*2)/Vs);
29 c=acos(V);
30 d=(c*180)/%pi;
31 u1=d-30;
32 disp(u1,"The overlap angle u1 in deg is:")
33 //Result vary due to error in calculation of overlap
    angle in the textbook

```

Scilab code Exa 3.6 Determine the overlap angle

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_6
5 clc;
6 clear;
7 Vs=220;//Supply voltage in V
8 f=50;//Frequency in Hz

```



```
Scilab 5.5.2 Console ? ^ X
The overlap angle in deg is:
3.5796029
-->
```

Figure 3.6: Determine the overlap angle

```

9 Eb=-200;//Back emf in V
10 Rd=3;//Resistance in ohm
11 Vdc=200;// voltage in V
12 Xc=0.314;//Reactance in ohm
13 L=0.001;//Inductance in mH
14 pf=-0.5;//Powerfactor
15 Vdia=0.9*Vs*pf;
16 Id=(Vdia-Eb)/(Rd+((2*Xc)/%pi));
17 Vd=Id*Rd+Eb;
18 a=-pf+((Vd*2)/Vdc);
19 b=acos(a);
20 c=(b*180)/%pi;
21 u=c-120;
22 disp(u,"The overlap angle in deg is:")
23 //Result vary due to error in calculation of overlap
    angle in the textbook

```

Scilab code Exa 3.7 Determine the overlap angle

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_7
5 clc;
6 clear;
7 Id=50;//Current in A
8 Vs=220;//Supply voltage in V
9 Vdio=257.4;// voltage in V
10 f=50;//Frequency in Hz
11 L=0.0015;//Inductance in mH
12 pf=0.866;//Powerfactor
13 Xc=2*%pi*f*L;

```

```
Scilab 5.5.2 Console ? ? x
the overlap angle in deg is:
8.8685784
-->
```

Figure 3.7: Determine the overlap angle

```
Scilab 5.5.2 Console ? ? x

load current in A is:

    64.9

Average value of load current in A is:

    20.6382

Rms value of load current in A is:

    35.746411

-->
```

Figure 3.8: Determine the average and rms value of load current

```
14 Vdia=1.17*Vs*pf;
15 Vd=Vdia-((3*Id*Xc)/(2*pi));
16 Vc=Vdia-Vd;
17 a=pf-((Vc*2)/Vdio);
18 b=acos(a);
19 c=(b*180)/pi;
20 u=c-30;
21 disp(u,"the overlap angle in deg is:")
```

Scilab code Exa 3.8 Determine the average and rms value of load current

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_8
5 clc;
6 clear;
7 Rd=2.5;//Resistance in ohm
8 V=250;// voltage in V
9 f=50;//Frequency in Hz
10 Vs=150;//Supply voltage in V
11 pf=-0.5;//Powerfactor
12 Eb=-250;//Back emf in V
13 Xc=0.636;//Reactance in ohm
14 Vdia=1.17*Vs*pf;
15 Id=(Vdia-Eb)/Rd;
16 disp(Id,"load current in A is:")
17 Ith=(Id*Xc)/2;
18 disp(Ith,"Average value of load current in A is:")
19 Irms=sqrt(3)*Ith;
20 disp(Irms,"Rms value of load current in A is:")
21 //Result vary due to error in calculation of current
    in the textbook

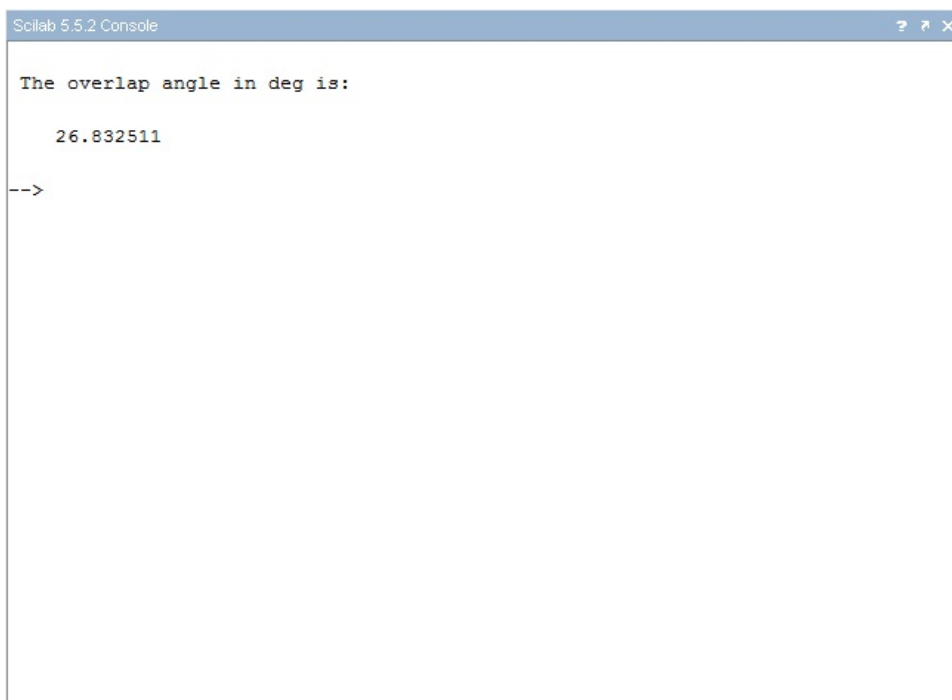
```

Scilab code Exa 3.9 Determine the overlap angle

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_9
5 clc;
6 clear;

```



```
Scilab 5.5.2 Console
The overlap angle in deg is:
26.832511
-->
```

Figure 3.9: Determine the overlap angle

```

7 L=0.003; //Inductance in mH
8 Id=64.9; //Current in A
9 V=162.25; //voltage in V
10 Vs=150; //Supply voltage in V
11 f=50; //Frequency in Hz
12 Rd=2.5; //Resistance in ohm
13 Eb=-250; //Back emf in V
14 pf=-0.5; //Powerfactor
15 Xc=2*%pi*f*L;
16 Vdia=(Id*(Rd+((3*Xc)/(2*%pi))))+Eb;
17 a=Vdia/(1.17*Vs);
18 b=acos(a);
19 c=(b*180)/%pi;
20 Alpha=-0.3338; //angle in radian
21 X=(3*Id*Xc)/(%pi*Vs);
22 d=acos(Alpha-X);
23 e=(d*180)/%pi;
24 u=e-c;
25 disp(u,"The overlap angle in deg is:")
26 //Result vary due to error in calculation of overlap
    angle in the textbook

```

Scilab code Exa 3.10 Determine the average value of load voltage and current and p

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex3_10
5 clc;
6 clear;
7 Vs=400; //Supply voltage in V
8 f=50; //Frequency in Hz

```

```
Scilab 5.5.2 Console ? ? x

Average value of load voltage in V is:

    139.752

Average value of load current in A is:

    9.3168

Power dissipation in W is:

    1302.0414

-->
```

Figure 3.10: Determine the average value of load voltage and current and power dissipation



The image shows a Scilab 5.5.2 Console window. The title bar reads "Scilab 5.5.2 Console" and has standard window controls (minimize, maximize, close). The main area of the console displays the following text: "The power factor is:" followed by the numerical value "0.2445021". Below the output, there is a prompt "-->" indicating the next command line.

Figure 3.11: Determine the powerfactor

```
9 Rd=15; //Resistance in ohm
10 pf=0.2588; //Powerfactor
11 Vdia=1.35*Vs*pf;
12 disp(Vdia,"Average value of load voltage in V is:")
13 Id=Vdia/Rd;
14 disp(Id,"Average value of load current in A is:")
15 P=Vdia*Id;
16 disp(P,"Power dissipation in W is:")
```

Scilab code Exa 3.11 Determine the powerfactor

```
Scilab 5.5.2 Console ? ↗ ✕

The max current in A is:

    20.785056

-->|
```

Figure 3.12: Determine the thyristor current

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex3_11
5 clc;
6 clear;
7 Alpha=75; // angle in degree
8 a=cos(Alpha);
9 b=a/3.6;
10 pf=(3*b)/%pi;
11 disp(pf, "The power factor is:")
```

Scilab code Exa 3.12 Determine the thyristor current

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex3_12
5 clc;
6 clear;
7 Vs=400; // Supply voltage in V
8 Id=9.317; // Current in A
9 pf=0.2588; // Powerfactor
10 Vth=sqrt(2)*Vs;
11 Ia=sqrt(2/3)*Id;
12 Ith=Ia/sqrt(2);
13 Imax=Ith/pf;
14 disp(Imax, "The max current in A is:")
```

Scilab code Exa 3.13 Determine the overlap angle

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex3_14
5 clc;
6 clear;
7 t0=1.5; // Time in ms
8 t1=3; // Time in ms
9 Vs=200; // Supply voltage in V
```

```
Scilab 5.5.2 Console ? ↗ ✕  
  
The overlap angle in deg is:  
  
    1.1630783  
  
-->
```

Figure 3.13: Determine the overlap angle



```
Scilab 5.5.2 Console
Ripple factor is:
  1.
-->
```

Figure 3.14: Determine the ripple factor

```
10 gama=t0/t1;
11 Vl=gama*Vs;
12 Vrms=sqrt(gama)*Vs;
13 Rf=(sqrt(1-gama))/(sqrt(gama));
14 disp(Rf,"Ripple factor is:");
```

Scilab code Exa 3.14 Determine the ripple factor

```
1 //Electric Drives:concepts and applications by V.
  subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
```

```
Scilab 5.5.2 Console ? ↗ ✕

Maximum current in A is:

    44.850018

Minimum current in A is:

    23.026767

-->|
```

Figure 3.15: Determine the maximum and minimum current

```
4 //Ex3_14
5 clc;
6 clear;
7 t0=1.5; //Time in ms
8 t1=3; //Time in ms
9 Vs=200; //Supply voltage in V
10 gama=t0/t1;
11 V1=gama*Vs;
12 Vrms=sqrt(gama)*Vs;
13 Rf=(sqrt(1-gama))/(sqrt(gama));
14 disp(Rf,"Ripple factor is:")
```

Scilab code Exa 3.15 Determine the maximum and minimum current

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex3_15
5 clc;
6 clear;
7 R=1.5; // Resistance in ohm
8 L=3; // Inductance in H
9 Ton=2; // Time in ms
10 T=6; // Time in ms
11 Vs=150; // Supply voltage in V
12 t=Ton/T;
13 tON=L/R;
14 Vavg=T*Vs;
15 Iavg=Vavg/R;
16 P=(Iavg)^2*R;
17 Io=23.032;
18 I=1-exp(-t);
19 I1=Io*exp(-t);
20 Imax=(Vs/R)*I+I1;
21 disp(Imax, "Maximum current in A is:")
22 Imin=Imax*exp(-2*t);
23 disp(Imin, "Minimum current in A is:")
```

Chapter 4

Control of Electric Motors

Scilab code Exa 4.1 Determine the average value of current

```
1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex4_1
5 clc;
6 clear;
7 Eb=50; // voltage in V
8 V=120; // voltage in V
9 f=50; // frequency in Hz
10 R=10; // Resistance in ohm
11 a=asin(Eb/(sqrt(2)*V));
12 Alpha=(a*180)/%pi;
13 pf=0.9556;
14 Iavg=(1/(2*%pi*R))*((2*sqrt(2)*V*pf)-(Eb*(%pi-(2*
  Alpha))));
15 disp(Iavg,"Current Iavg in A is:")
```

```
Scilab 5.5.2 Console ? ? X  
  
Current Iavg in A is:  
  
29.933606  
  
-->
```

Figure 4.1: Determine the average value of current

```
Scilab 5.5.2 Console ? ? X

Efficiency in % is:

81.151978

-->
```

Figure 4.2: Determine the efficiency

Scilab code Exa 4.3 Determine the efficiency

```
1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex4_3
5 clc;
6 clear;
7 P=10000;
8 V=240; // voltage in V
```

```

 9 N=1000; //Speed in rpm
10 Eff1=0.87; //Efficiency in %
11 Vs=250; // voltage in V
12 f=50; //frequency in Hz
13 Alpha=0.5; //angle
14 R=0.40; // Resistance in ohm
15 Fdf=1; //fundamental displacement factor
16 df=0.9; //distortion factor
17 pf=0.9; //the power factor
18 Pi=P/Eff1;
19 I=Pi/V;
20 Eb=V-(I*R);
21 Vi=0.9*Vs;
22 Eb1=Vi-(I*R);
23 N1=(Eb1/Eb)*N;
24 Pi1=V*I*pf*(10)^(-3);
25 Pi2=(Pi1*N1)/N;
26 Vc=0.9*Vs*Alpha;
27 Eb2=Vc-(I*R);
28 N2=(N*Eb2)/Eb;
29 P0=((Pi1*N2)/N)*1000;
30 Pi0=Vc*I;
31 Eff=(P0/Pi0)*100;
32 disp(Eff," Efficiency in % is:")
33 //Result vary due to roundoff error

```

Scilab code Exa 4.4 Determine the powerfactor

```

1 // Electric Drives: concepts and applications by V.
  subrahmanyam
2 // Publisher : Tata McGraw-Hill
3 // Edition : Second
4 // Ex4_4

```



```
Scilab 5.5.2 Console ? ? X  
  
powerfactor is:  
  
    0.7794  
-->|
```

Figure 4.3: Determine the powerfactor

```
Scilab 5.5.2 Console
The firing angle in deg is:
57.486385
-->
```

Figure 4.4: Determine the firing angle

```
5 clc;
6 clear;
7 V=250; // voltage in V
8 f=50; //frequency in Hz
9 R=1.5; // Resistance in ohm
10 L=30; //inductance in mH
11 Eb=100; //Back emf in V
12 Alpha=0.866; // angle
13 Vc=0.9*V*Alpha;
14 Id=(Vc-Eb)/R;
15 P=Vc*Id*10(-3);
16 pf=0.9*Alpha;
17 disp(pf," powerfactor is:")
```

Scilab code Exa 4.5 Determine the firing angle

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex4_5
5 clc;
6 clear;
7 N=1800; // Speed in rpm
8 I=60; // Current in A
9 V=400; // voltage in V
10 E=185; // Back emf in V
11 N2=900; // Speed in rpm
12 R=0.5; // Resistance in ohm
13 Vs=V/2.34;
14 V1=V/1.35;
15 Vi=V-(I*R);
16 V=E+(I*R);
17 a=acos(V/(2.34*Vs));
18 Alpha=(a*180)/%pi;
19 disp(Alpha, "The firing angle in deg is:")
```

Scilab code Exa 4.6 Determine the firing angle

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex4_6
```

```
Scilab 5.5.2 Console ? ↗ ✕  
  
The firing angle in deg is:  
  
71.503638  
  
-->
```

Figure 4.5: Determine the firing angle

```

5  clc;
6  clear;
7  V=500; // voltage in V
8  Vs=250; // voltage in V
9  I=181; // Current in A
10 N=1500; // Speed in rpm
11 R=0.1; // Resistance in ohm
12 f=50; // frequency in Hz
13 Eb=Vs-(I*R);
14 Eb1=Eb/3;
15 A1=acos(Vs/(1.35*V));
16 Alpha1=(A1*180)/%pi;
17 Ia2=I/9;
18 V2=Eb1+(Ia2*R);
19 A2=acos(V2/(1.35*V));
20 Alpha2=(A2*180)/%pi;
21 V1=Vs/1.35;
22 A3=acos(V2/(1.35*V1));
23 Alpha3=(A3*180)/%pi;
24 disp(Alpha3,"The firing angle in deg is:")

```

Scilab code Exa 4.7.a Determine the firing angle

```

1  // Electric Drives: concepts and applications by V.
   subrahmanyam
2  // Publisher: Tata McGraw-Hill
3  // Edition: Second
4  // Ex4_7a
5  clc;
6  clear;
7  V=300; // voltage in V
8  Vt=363.25; // voltage in V
9  f=60; // frequency in Hz

```



```
Scilab 5.5.2 Console ? ↗ ✕  
  
The firing angle in deg is:  
  
    26.244709  
-->|
```

Figure 4.6: Determine the firing angle

```
Scilab 5.5.2 Console ? ↗ ✕  
  
The back emf in V is:  
  
173.25  
  
-->
```

Figure 4.7: Determine the back emf voltage

```
10 Rd=0.02; // Resistance in ohm  
11 La=0.002; // inductance in H  
12 Id=500; // Current in A  
13 N=1500; // Speed in rpm  
14 Eb=Vt-(Id*Rd);  
15 A=acos(Vt/(1.35*V));  
16 Alpha=(A*180)/%pi;  
17 disp(Alpha,"The firing angle in deg is:")
```

Scilab code Exa 4.7.b Determine the back emf voltage

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex4_7b
5 clc;
6 clear;
7 V=300;// voltage in V
8 Vt=363.25;// voltage in V
9 f=60;//frequency in Hz
10 Rd=0.02;// Resistance in ohm
11 La=0.001;//inductance in H
12 Id=500;//Current in A
13 N=1500;//Speed in rpm
14 Xc=2*%pi*f*La;
15 Z=Rd+((3*Xc)/%pi);
16 Eb=Vt-(Id*Z);
17 disp(Eb,"The back emf in V is:")

```

Scilab code Exa 4.8 Determine the constant

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex4_8
5 clc;
6 clear;
7 V=600;// voltage in V
8 R=0.16;// Resistance in ohm
9 Ia=210;//Current in A
10 N=600;//Speed in rpm
11 n=10;//no of unit

```

```
Scilab 5.5.2 Console
The constant A is:
0.4795158
-->
```

Figure 4.8: Determine the constant

```
Scilab 5.5.2 Console

The back emf in V is:

    360.

The firing angle1 in deg is:

    139.32136

The firing angle2 in deg is:

    98.111126

-->
```

Figure 4.9: Determine the back emf and firing angle

```
12 Eb=V-(Ia*R);
13 Td=((Eb*Ia)/(2*pi*n));
14 W=(2*pi*N)/60;
15 A=Td/(W)^2;
16 disp(A,"The constant A is:")
```

Scilab code Exa 4.9 Determine the back emf and firing angle

```
1 //Electric Drives:concepts and applications by V.
  subrahmanyam
2 //Publisher:Tata McGraw-Hill
```

```

3 //Edition:Second
4 //Ex4_9
5 clc;
6 clear;
7 V1=500; // voltage in V
8 V2=450; // voltage in V
9 Vs=420; // voltage in V
10 V=400; // voltage in V
11 I=60; //Current in A
12 R=1.5; // Resistance in ohm
13 R1=5; // Resistance in ohm
14 Eb=20; //Back emf in V
15 f=50; //frequency in Hz
16 V1=V2+Eb;
17 A=acos(V1/(1.35*Vs));
18 Alpha1=(A*180)/%pi;
19 Eb1=V2-(I*R);
20 disp(Eb1,"The back emf in V is:")
21 V3=-V2-(I*R);
22 Vc=-V2+Eb;
23 A1=acos(Vc/(1.35*Vs));
24 Alpha2=(A1*180)/%pi;
25 disp(Alpha2,"The firing angle1 in deg is:")
26 Eb2=-V-(I*R);
27 Vc1=-V+Eb+(R1*I);
28 A2=acos(Vc1/(1.35*Vs));
29 Alpha3=(A2*180)/%pi;
30 disp(Alpha3,"The firing angle2 in deg is:")

```

Scilab code Exa 4.10 Determine the inductance

```

1 //Electric Drives:concepts and applications by V.
  subrahmanyam

```

```
Scilab 5.5.2 Console ? ↗ ✕  
  
The inductance in Henry is:  
  
    0.1  
-->
```

Figure 4.10: Determine the inductance

```

2 // Publisher : Tata McGraw-Hill
3 // Edition : Second
4 // Ex4_10
5 clc;
6 clear;
7 V=500; // voltage in V
8 I=15; // Current in A
9 t=0.6; // time in sec
10 f=80; // frequency in Hz
11 Vav=V*t;
12 Vi=V-Vav;
13 Ton=t/f;
14 L=Vi*(Ton/I);
15 disp(L,"The inductance in Henry is:")

```

Scilab code Exa 4.12 Determine the current

```

1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher : Tata McGraw-Hill
3 // Edition : Second
4 // Ex4_12
5 clc;
6 clear;
7 V=460; // voltage in V
8 N1=1200; // Speed in rpm
9 N2=1000; // Speed in rpm
10 r1=0.06; // Resistance in ohm
11 r2=0.32; // Resistance in ohm
12 x1=2.16; // Reactance in ohm
13 x2=0.48; // Reactance in ohm
14 x=0.6*i; // Reactance in ohm
15 xm=8*i; // Reactance in ohm

```



```
Scilab 5.5.2 Console ? ↗ ✕  
  
The current in A is:  
  
58.723271  
  
-->
```

Figure 4.11: Determine the current



The image shows a Scilab 5.5.2 Console window. The title bar reads "Scilab 5.5.2 Console". The main area of the window contains the following text: "The time ratio is:", followed by the numerical value "0.7619048". Below this, there is a prompt "-->" indicating the next step in the execution.

Figure 4.12: Determine the time ratio

```
16 S1=(N1-N2)/N1;  
17 Z=(xm+(x1+x))/(x1+xm+x);  
18 [M, P] = polar(Z);  
19 M * exp(%i * P);  
20 disp(Z, "z:")
```

Scilab code Exa 4.14 Determine the time ratio

```
1 // Electric Drives: concepts and applications by V.  
  subrahmanyam  
2 // Publisher : Tata McGraw-Hill  
3 // Edition : Second
```

```

4 //Ex4_14
5 clc;
6 clear;
7 V=440; // voltage in V
8 R1=0.07; // Resistance in ohm
9 R2=0.05; // Resistance in ohm
10 X=0.2; //Reactance in ohm
11 N=1420; //Speed in rpm
12 Xm=20; //Reactance in ohm
13 S1=80; //slip in rpm
14 S2=500; //slip in rpm
15 Ra=((S2/S1)*R2)-R2;
16 R=2*Ra;
17 Ra1=4*R2;
18 T=(Ra1*2)/R;
19 disp(T,"The time ratio is:")

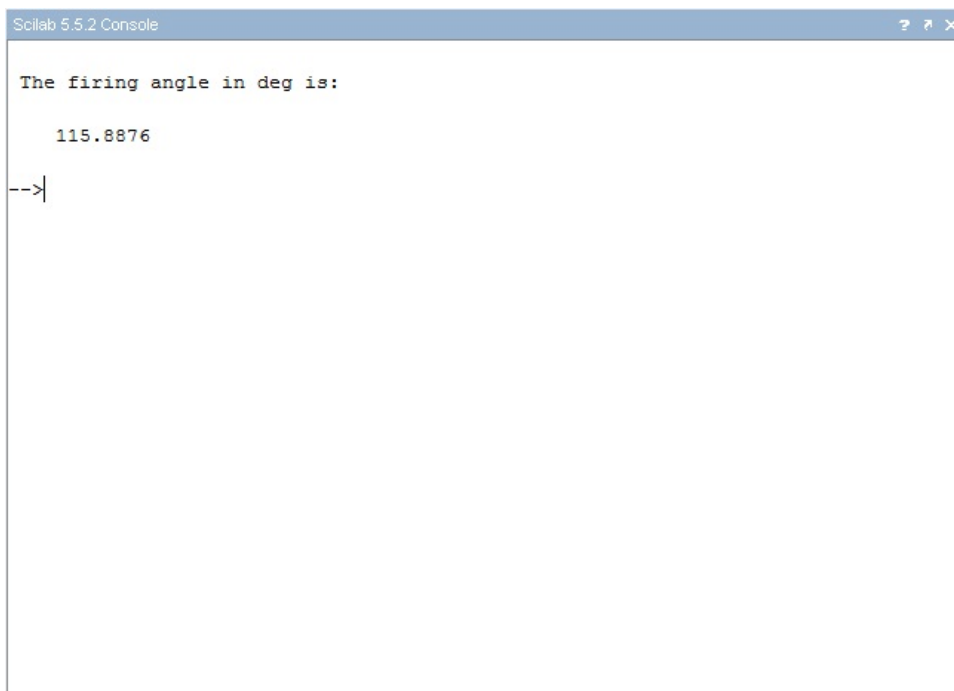
```

Scilab code Exa 4.15 Determine the firing angle

```

1 //Electric Drives:concepts and applications by V.
   subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex4_15
5 clc;
6 clear;
7 P=1000;
8 N=1500; //Speed in rpm
9 R2=0.06; // Resistance in ohm
10 I2=125.6; //Current in A
11 T=1.5; //Time in sec
12 N1=1420; //Speed in rpm
13 S=(R2*P)/N;

```



```
Scilab 5.5.2 Console
The firing angle in deg is:
115.8876
-->
```

Figure 4.13: Determine the firing angle

```
Scilab 5.5.2 Console ? ↗ ✕

The rms value of current I1 in A:

    0.9692391

The rms value of current I2 in A:

    0.9676617

The rms value of current I3 in A:

    0.9098249

-->
```

Figure 4.14: Determine the rms value of current

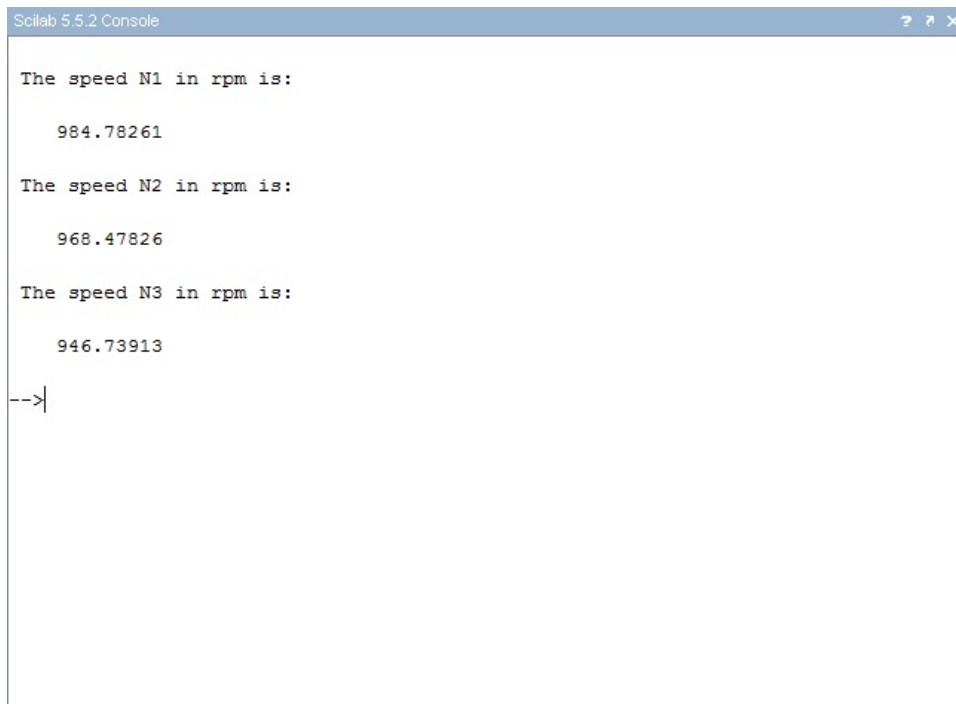
```
14 K=((S/(2*%pi*N))*(I2)^2*T)/(N1)^2;
15 T1=K*(N1)^2;
16 N2=750; //Speed in rpm
17 S0=0.489; //No load slip
18 S2=1.12; //load slip
19 T2=K*(N2)^2;
20 X1=(T2*S)/T1;
21 A=acos(-S0/S2);
22 Alpha=(A*180)/%pi;
23 disp(Alpha,"The firing angle in deg is:")
```

Scilab code Exa 4.19 Determine the rms value of current

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex4_19
5 clc;
6 clear;
7 V=400;// voltage in V
8 R1=10;// Resistance in ohm
9 R2=5;// Resistance in ohm
10 X1=2.6*%i;//Reactance in ohm
11 X2=2.4*%i;//Reactance in ohm
12 Xm=36.4*%i;//Reactance in ohm
13 Z=0.06;//zigma value
14 C=486;//constant
15 F4=2.5;//frequency in Hz
16 F2=25;//frequency in Hz
17 Z1=(1+X1)+((Xm*(R1+X2))/(R1+X2+Xm));
18 [M, P] = polar(Z1);
19 M * exp(%i * P);
20 Ieff1=sqrt(1+(M/(Z*Xm))^2*(((R2*(%pi)^4)/C)-1));
21 disp(Ieff1,"The rms value of current I1 in A:")
22 Z2=(1+(X1/2))+(((Xm/2)*((R1/2)+(X2/2)))/((R1/2)+X2+(
    Xm/2)));
23 [M, P] = polar(Z2);
24 M * exp(%i * P);
25 Ieff2=sqrt(1+(M/(Z*(Xm/2)))^2*(((R2*(%pi)^4)/C)-1));
26 disp(Ieff2,"The rms value of current I2 in A:")
27 S=(F4/F2);
28 Z3=(1+(X1*S))+(((Xm*S)*((R1*S)+(X2*S)))/((R1*S)+(X2*
    S)+(Xm*S)));
29 [M, P] = polar(Z3);
30 M * exp(%i * P);
31 Ieff3=sqrt(1+(M/(Z*(Xm*S)))^2*(((R2*(%pi)^4)/C)-1));
32 disp(Ieff3,"The rms value of current I3 in A:")

```



The speed N1 in rpm is:
984.78261

The speed N2 in rpm is:
968.47826

The speed N3 in rpm is:
946.73913

-->|

Figure 4.15: Determine the speed

Scilab code Exa 4.20 Determine the speed

```
1 // Electric Drives: concepts and applications by V.  
  subrahmanyam  
2 // Publisher: Tata McGraw-Hill  
3 // Edition: Second  
4 // Ex4_20  
5 clc;  
6 clear;  
7 R=0.05; // Resistance in ohm  
8 N0=1000; // Speed in rpm
```

```
9 Rf=46; // Resistance in ohm
10 I1=75; //Current in A
11 I2=150; //Current in A
12 I3=250; //Current in A
13 V=230; // voltage in V
14 Eb=230; //Back emf in V
15 If=V/Rf;
16 Ia1=I1-If;
17 Eb1=V-(Ia1*R);
18 N1=(Eb1/Eb)*N0;
19 disp(N1,"The speed N1 in rpm is:")
20 Ia2=I2-If;
21 Eb2=V-(Ia2*R);
22 N2=(Eb2/Eb)*N0;
23 disp(N2,"The speed N2 in rpm is:")
24 Ia3=I3-If;
25 Eb3=V-(Ia3*R);
26 N3=(Eb3/Eb)*N0;
27 disp(N3,"The speed N3 in rpm is:")
```

Chapter 5

Rating and Heating of Motors

Scilab code Exa 5.1 Determine the temperature

```
1 //Electric Drives:concepts and applications by V.
   subrahmanyam
2 //Example:5.1
3 clc;
4 clear;
5 theta1=60;//Temperature rise of motor in degree
6 theta2=40;//Temperature rise of motor in degree
7 e=0.5;//exponential value
8 I1=110;//current in A
9 I2=125;//current in A
10 t1=4;//Time in hour
11 t2=8;//Time in hour
12 theta=theta1/theta2;
13 tough=-(1/log(0.5));
14 thetam1=theta2/e;
15 thetam2=thetam1*(I2/I1)^2;
16 x=t1/(theta1*tough);
17 a=exp(-x);
18 y=t2/(theta1*tough);
```

```
Scilab 5.5.2 Console ? ↗ ✕  
  
The final temperature in deg is:  
  
43.606211  
  
-->|
```

Figure 5.1: Determine the temperature

```
Scilab 5.5.2 Console ? ↗ ✕

The permissible overloading is:

    1.2397292

-->
```

Figure 5.2: Determine the overloading

```
19 b=exp(-y);
20 thetam=I2*((1-a)/(1-(a*b)));
21 disp(thetam,"The final temperature in deg is:")
```

Scilab code Exa 5.2 Determine the overloading

```
1 // Electric Drives: concepts and applications by V.
   subrahmanyam
2 // Publisher: Tata McGraw-Hill
3 // Edition: Second
4 // Ex5_2
5 clc;
```

```
Scilab 5.5.2 Console ? ↗ ✕

The permissible overloading of the motor is:

1.6025383

-->
```

Figure 5.3: Determine the overloading

```
6 clear;
7 T=100; //Temperature rise of motor in degree
8 t1=2; //Time in hour
9 t2=1.5; //Time in hour
10 Alpha=0.5; //Angle in rad
11 e=exp(-t1/t2);
12 thetam=100/(1-e);
13 t=thetam/T;
14 x=sqrt((t*(Alpha+1))-Alpha);
15 disp(x,"The permissible overloading is:")
```

Scilab code Exa 5.3 Determine the overloading

```

1 //Electric Drives:concepts and applications by V.
    subrahmanyam
2 //Publisher:Tata McGraw-Hill
3 //Edition:Second
4 //Ex5_3
5 clc;
6 clear;
7 Alpha=0.4;//Angle in rad
8 T1=100;//Temperature rise of motor in degree
9 T2=150;//Temperature rise of motor in degree
10 P=125;//Power in KW
11 t1=15;//Time in hour
12 t2=30;//Time in hour
13 x=-t1/T1;
14 a=exp(x);
15 y=-t2/T2;
16 b=exp(y);
17 p=sqrt((Alpha+1)*(1-(a*b)))/(1-a)-Alpha);
18 disp(p,"The permissible overloading of the motor is:
    ")

```
