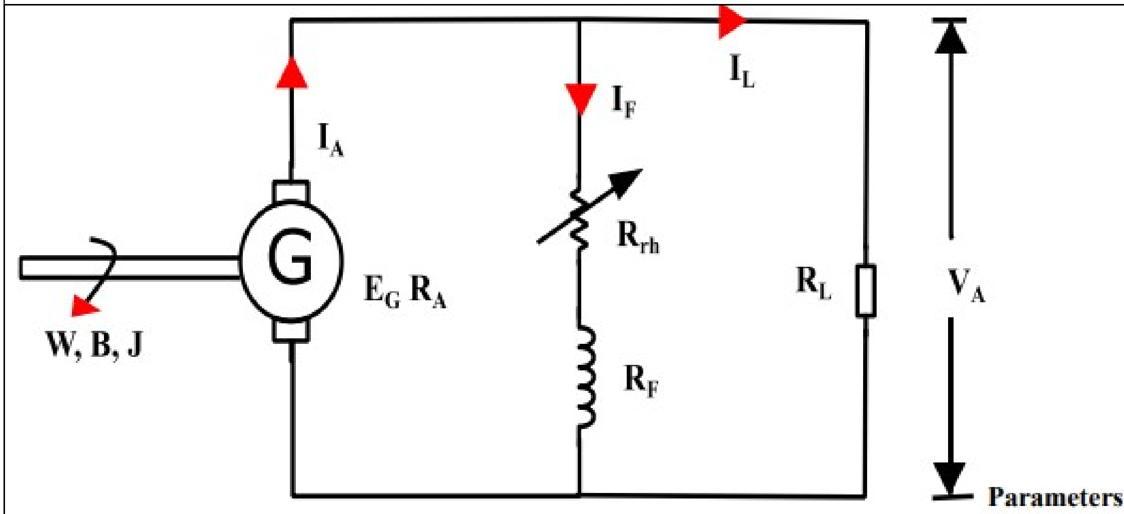
TITLE OF THE EXERCISE: DC shunt generator

DATE:06/10/20

AIM: To develop and Simulate mathematical dynamic modal of DC shunt generator under magnetic saturation c and also analyze with theoretical results.

TOOL USED: MATLAB and SIMULINK



ELECTRICAL CIRCUIT: PARAMETERS USED FOR THE STUDY:

Armature resistance RA= 0.24 ohms

Armature winding inductance LA=0.018H

Shunt field winding resistance RF=111 ohms

Shunt field winding inductance LF=10H

Shunt field Rheostat Resistance Rrh=25 ohms

Load resistance RL=100000 ohms

Rated Voltage VA=125 volts

Rated Current IA=16 amps

Rated power P=2KW

Rated Speed ωm=183 rad/sec

Speed ωmo= 209.5rad/sec (speed at Give field current and voltage Data)

Carbon brush Voltage Drop Vbrush=2volt

Field Current	Generated Voltage Ego
0	7.5
0.05	12
0.1	20
0.13	24
0.18	32
0.22	40
0.26	48
0.32	59
0.36	66
0.4	74
0.47	86
0.54	97
0.575	102.5
0.61	107.5

0.64	112
0.68	117
0.71	121
0.74	125
0.78	130
0.82	135
0.86	140
0.9	143
0.93	146
1	152
1.1	158
1.2	164
1.3	168
1.4	172
1.5	175

Theoretical Analysis: The open circuit characteristics of the dc shunt motor is observed under two different speeds And the corresponding effect of varying If,Iar,wm,RL are noted.

Calculations (Predetermination):

If = 1 A;

Vf = (Rf+Rrh) * If = (111+25)*1 = 136 V;

IL = 136/(1E6) A = 0.136 mA

Ia = IL + If = 1 + 0.000136 A = 1.000136 A Eg

= Va +IaRa+Vb = 136 + 0.24 +2 = 138.24 V

wm = (138.24/152)*209.5 = 190.5 rad/sec;

Kϕ =Eg/wm = 0.7255 Vs

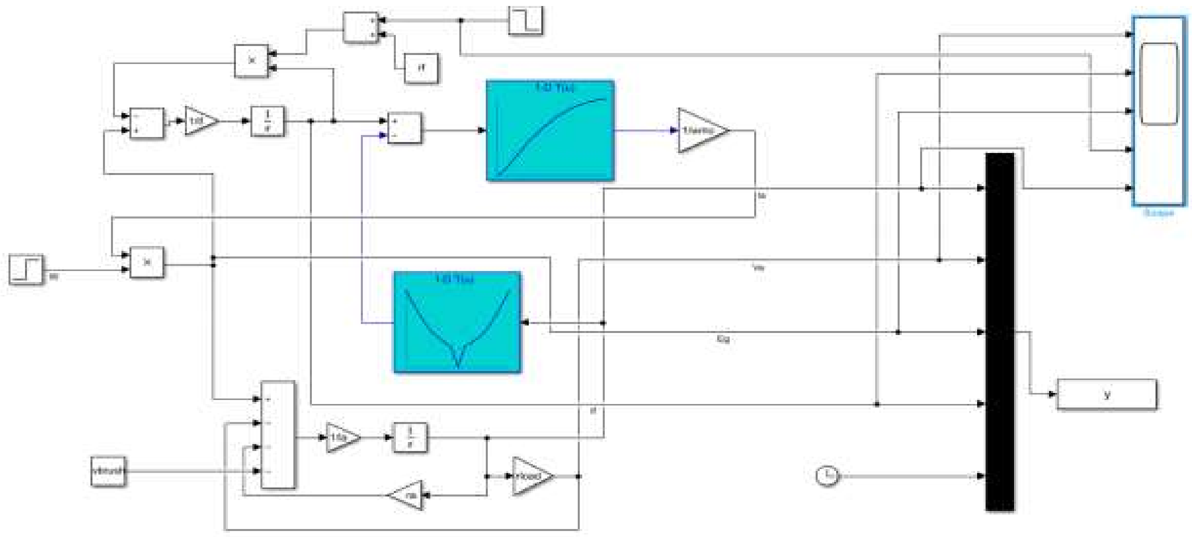
Te = Kϕ*Ia = 0.7255*1.000136 = 0.7256 Nm

Procedure for simulation study:

- Step1-Write the coding for Initialize the input parameters and as per requirement of plots in m file and save it
- Step 2-open new Simulink file and make mathematical modelling as per circuit diagram and save it
- Step3-Run the m file first, after that run Simulink file
- Step4-View the result in Scope
- Step5- Again run m file and view the plots
- Step6-Make various plots and write the Results

Simulation Diagram and m.file coding :

Simulation rendered wave form:-



```
prated = 2000;
vrated = 125;
Iarated =16;
wmrated =1750*(2*pi)/60;
Trated = prated/wmrated;
ra =0.24;
rf =111;
rrh = 25;
la = 0.018;
lf = 10;
rload = 1e6;
j = 0.8;
vbrush =2;
wmo = 2000*(2*pi)/60;

SHVP1 = [7.5 12 20 24 32 40 48 59 66 74 86 97 102.5 ...
107.5 112 117 121 125 130 135 140 143 146 152 158 164 168 172 175];

SHIP1 = [0 0.05 0.1 0.13 0.18 0.22 0.26 0.32 0.36 0.4 0.47 0.54 ...
 0.575 0.61 0.64 0.68 0.71 0.74 0.78 0.82 0.86 0.9 0.93 1.0 1.1 ...
 1.2 1.3 1.4 1.5];

plot(SHIP1,SHVP1);
Ia = [-40:5:40];
Iar = 0.04*abs(atan(Ia)) + 0.0001*Ia.^2;

keyboard
subplot(4,1,1)
plot(y(:,5),y(:,4))
ylabel("If in A");
subplot(4,1,2)
plot(y(:,5),y(:,3))
ylabel("Eb in V");
subplot(4,1,3)
plot(y(:,5),y(:,1))
ylabel("Ia in A");
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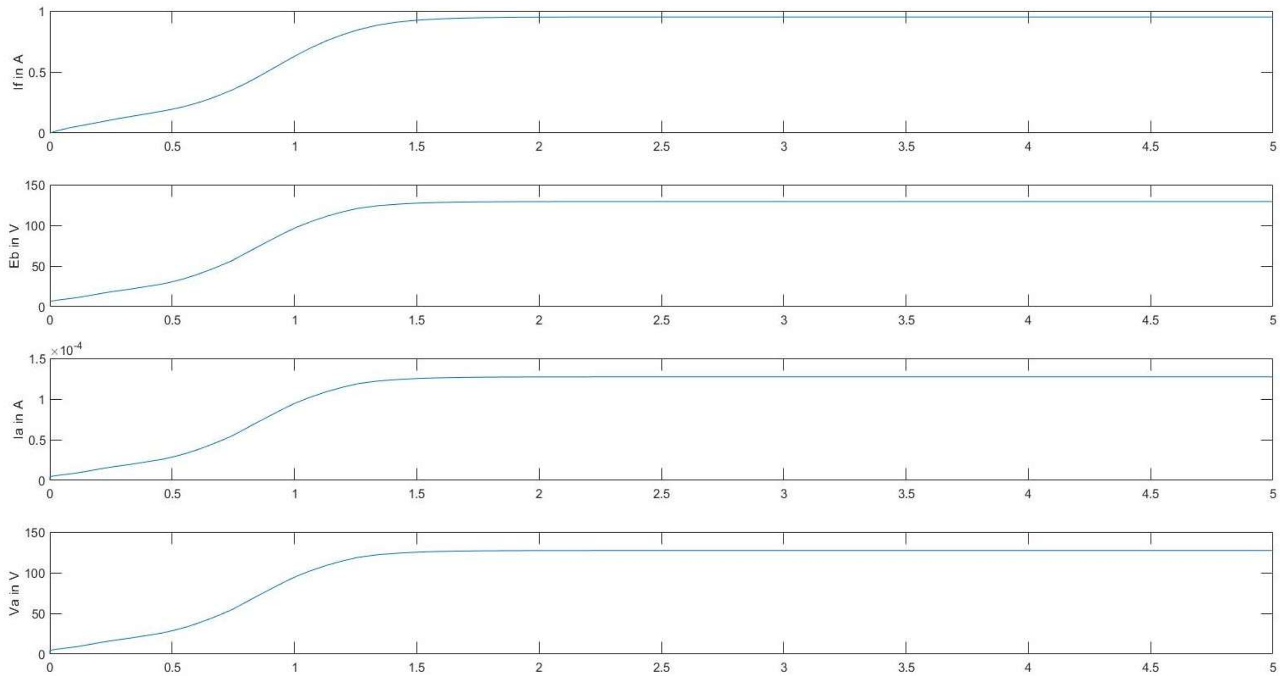
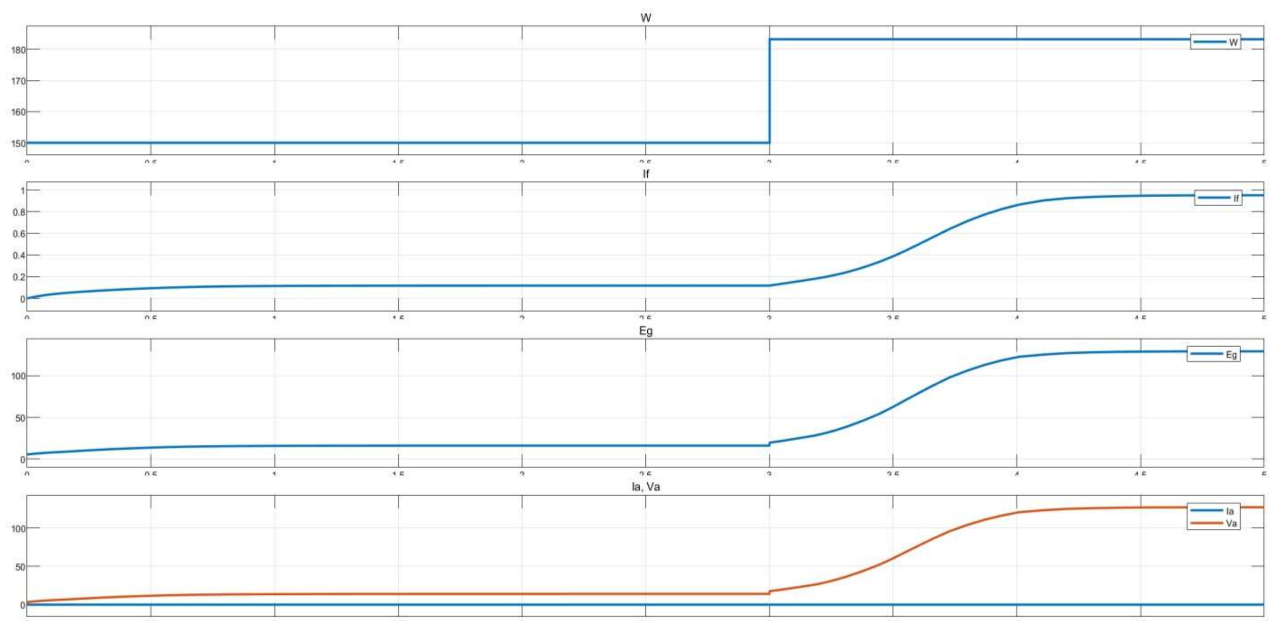
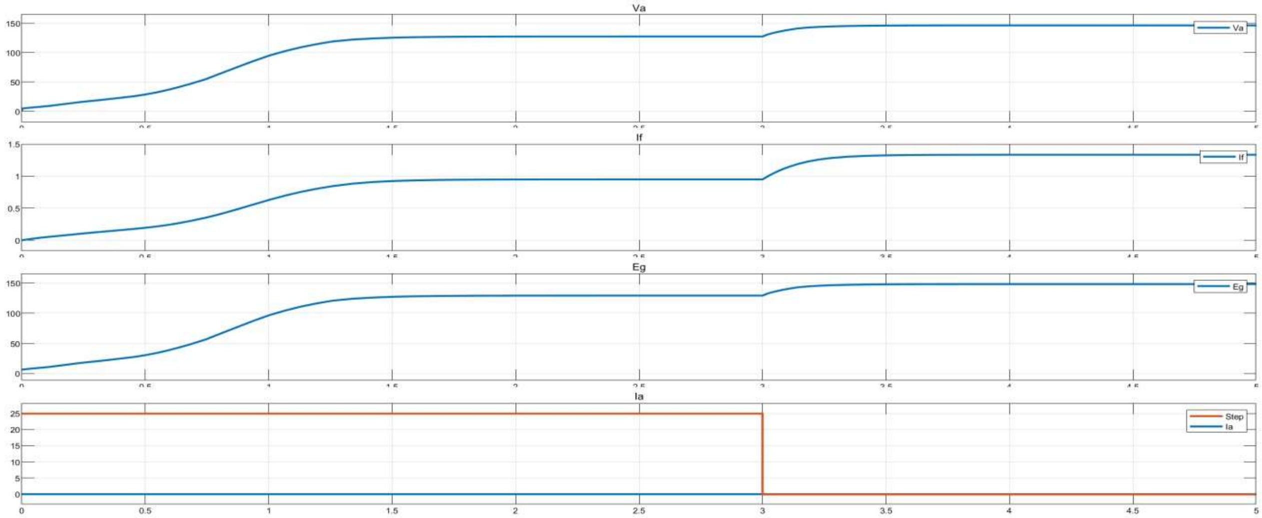
```
subplot(4,1,4)
plot(y(:,5),y(:,2))
ylabel("Va in V");
```

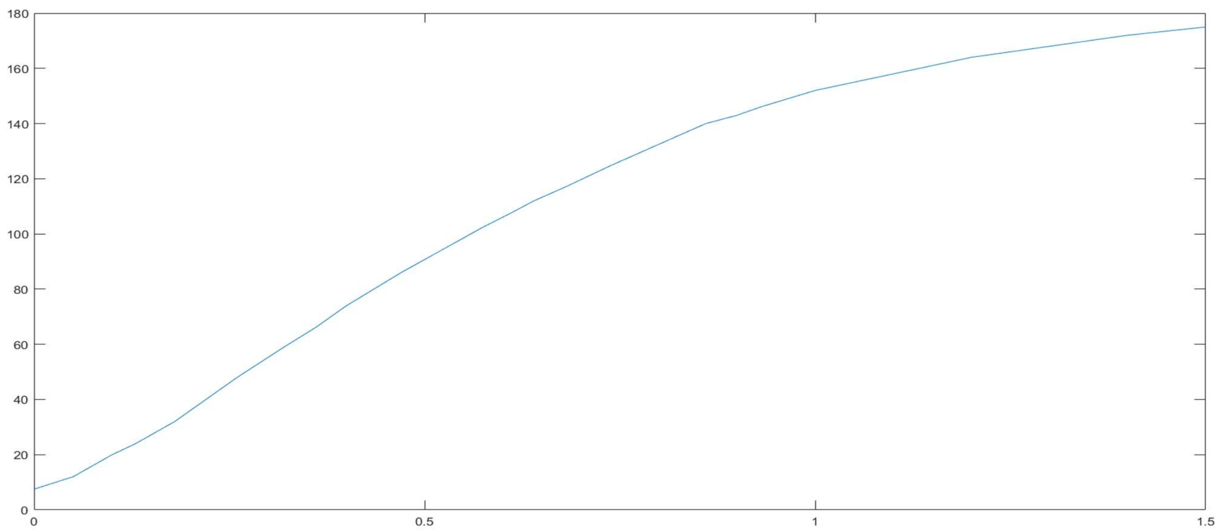
Results and Discussions:

This section contains both waveforms with respect to time along with the theoretical value.









Simulation rendered waveforms

Comparison (Observations): Hence, we were able to obtain the plots for dc shunt generator under magnetic saturation conditions.
Conclusion: Hence, we were able to obtain the plots for dc shunt generator under magnetic saturation conditions.
Inference: We were able to see the effects of armature reaction in a dc shunt generator
References: -NIL-