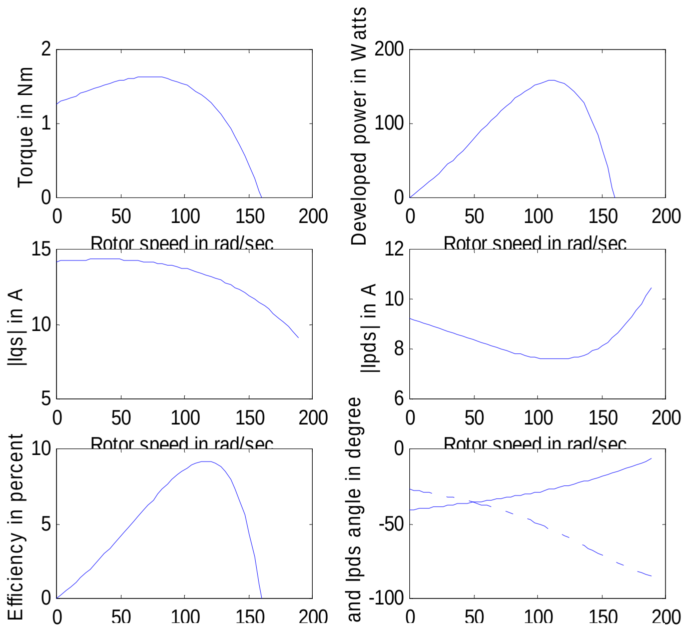
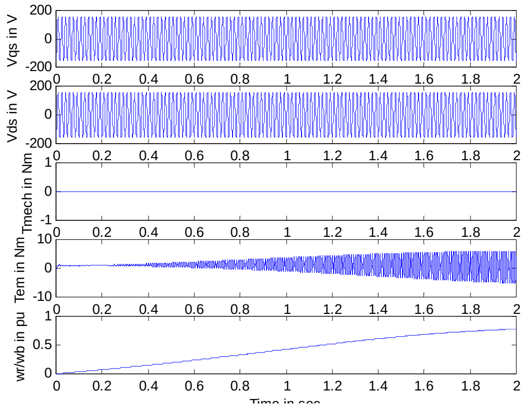
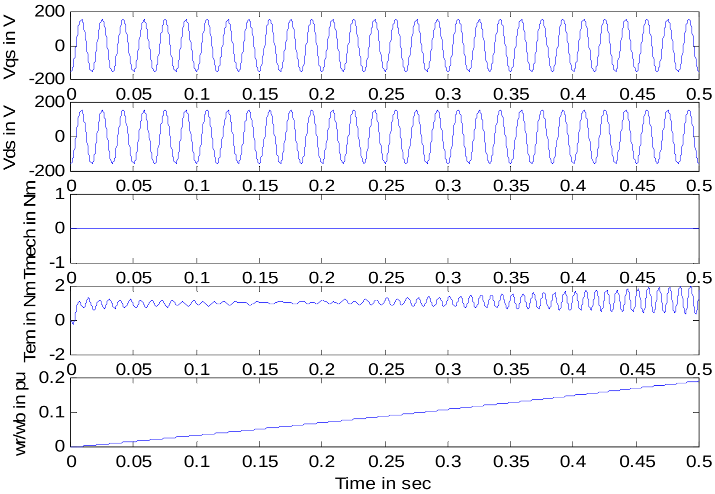


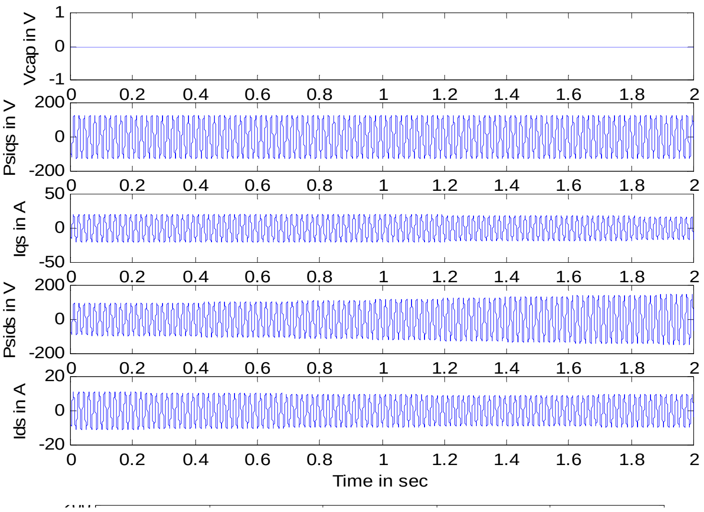


الشكل(10):. حمل حمل

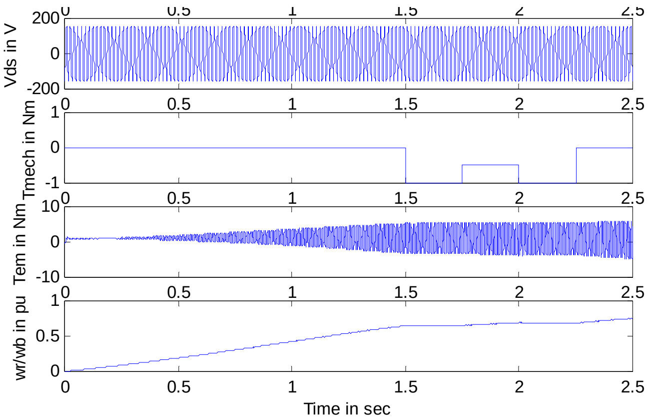


الشكل(11-A): منحنيات الأداء لمحرك ذي طور مشطور عند حالة إقلاع دون حمل

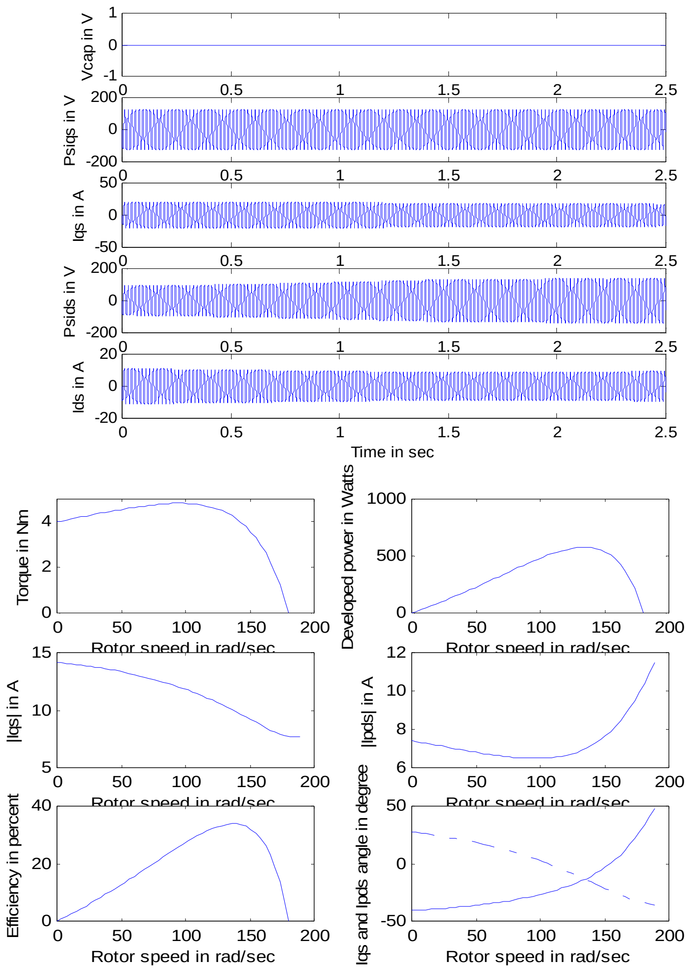
رسمت خلال زمن أصغر لتوضيح شكل دقيق للإشارات في الشكل (11)



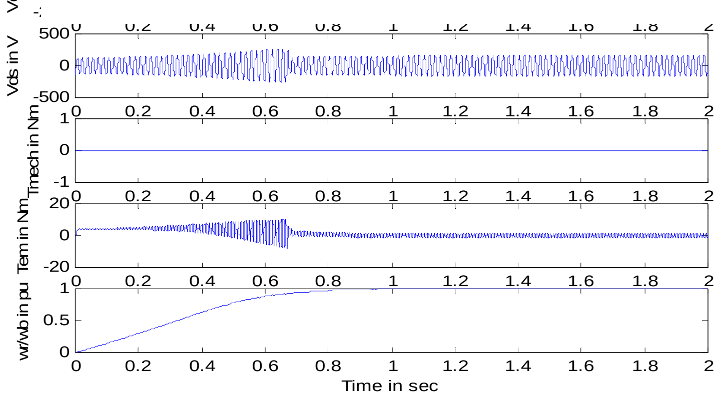
الشكل(12): تابع الأداء لمحرك ذي طور مشطور عند حالة إقلاع دون حمل



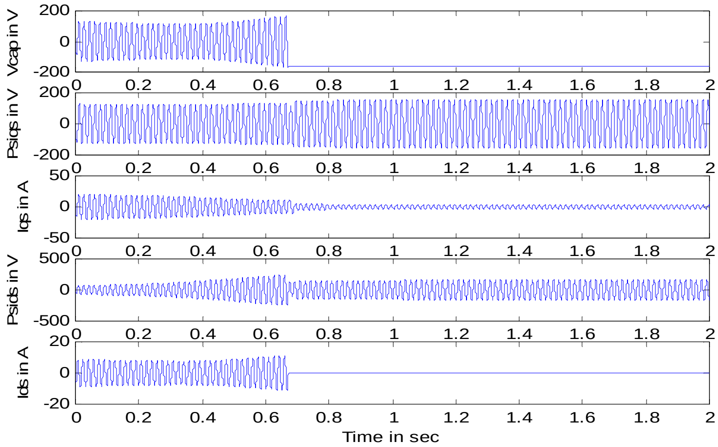
الشكل(13): منحنيات الأداء لمحرك ذي طور مشطور عند حالة إقلاع دون حمل وتحميله بشكل قفزات



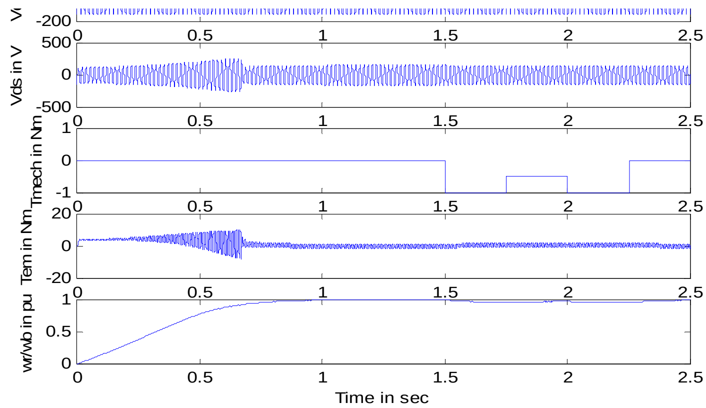
الشكل(15): منحنيات خواص عزم – سرعة لمحرك ذي مكثف إقلاع عند حالة إقلاع دون حمل



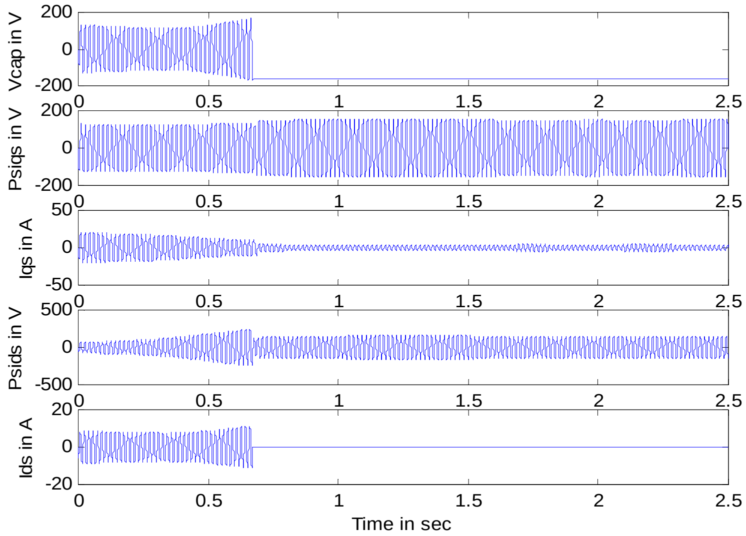
الشكل(16): منحنيات الأداء لمحرك ذي مكثف إقلاع عند حالة إقلاع دون حمل

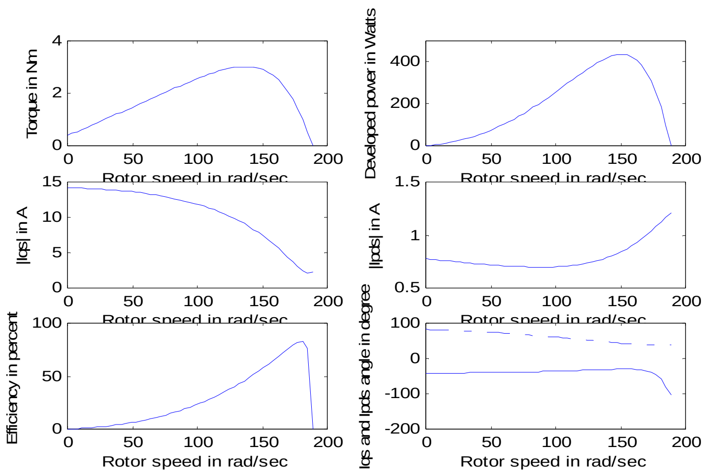


الشكل(17): تتمة منحنيات الأداء لمحرك ذي مكثف إقلاع عند حالة إقلاع دون حمل

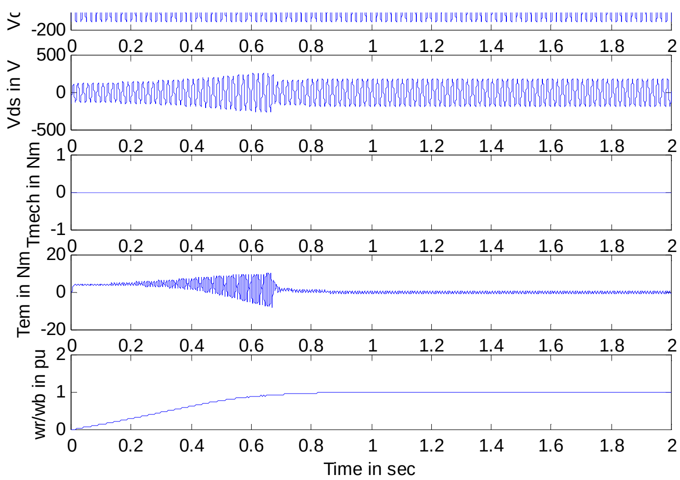


الشكل(18): منحنيات الأداء لمحرك ذي مكثف إقلاع عند حالة إقلاع دون حمل ثم تحميله بشكل قفزات

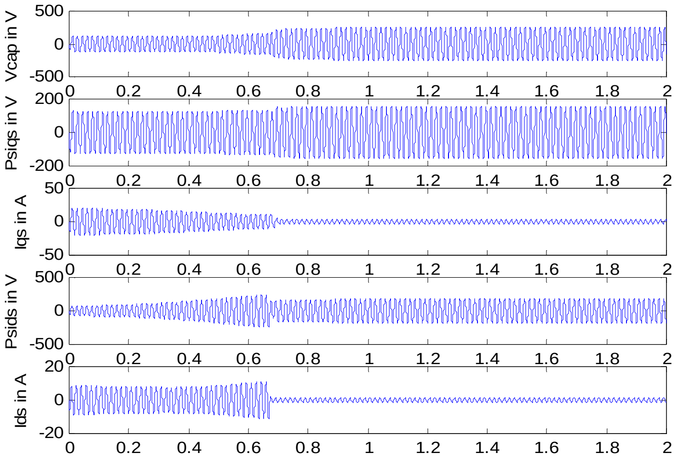




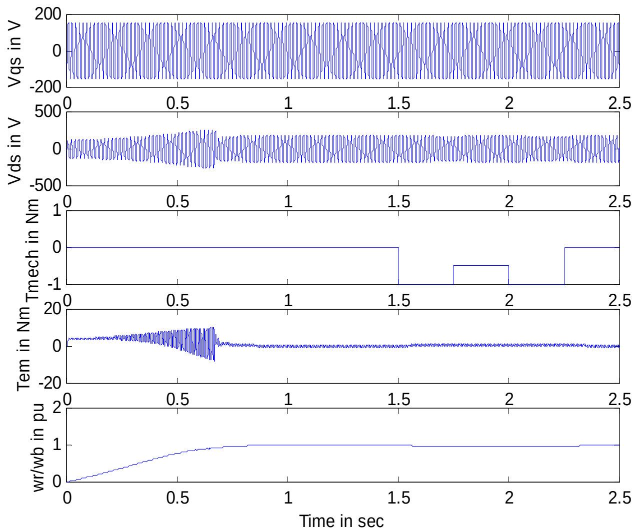
الشكل(20): منحنيات خواص عزم - سرعة لمحرك ذي مكثف إقلاع ومكثف دائم



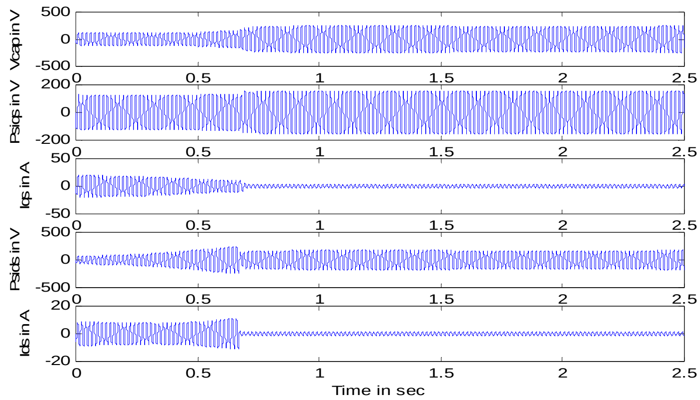
الشكل(21): منحنيات الأداء لمحرك ذي مكثف إقلاع ومكثف دائم عند حالة إقلاع دون حمل



الشكل(2



الشكل(23): منحنيات الأداء لمحرك ذي مكثف إقلاع ومكثف دائم عند حالة إقلاع دون حمل ثم تحميله بشكل قفزات



الشكل(24): تتمة منحنيات الأداء لمحرك ذي مكثف إقلاع ومكثف دائم عند حالة إقلاع دون حمل ثم تحميله بشكل قفزات

[1] – Chee-Mun Ong , “Dynamic Simulation of Electric Machine” , Using Matlab/ Simulink .Book , 1998 , p. 167 – p. 258 .

[2] – Matlab ver. 6.3 , Simulink, “ Dynamic System Simulation for Matlab, “ manual , Mathworks, Inc., 2000- 2001.

[3] – Krause,P.C. ,(1965), “Simulation of Unsymmetrical 3 phase Induction Machines.”IEEE, Trans. Power Apparatus and system,Vol.84,No.11 , 1965 ,pp.1025- 1037.

[4] – Grace, A. ,Laub,A.,J.,Little,J.N., and ,Thompson,C.(1990),Control System Toolbox User’s Guide ,The Mathworks,Inc., 1990,Natick,MA.

Appendix 1

(m.m) الملف

```
% M file for single-phase induction motor
% It sets the machine parameters and
% also plots the simulated results when used in conjunction
% with SIMULINK file s.m.

clear all % clear workspace
% select machine parameter file to enter into Matlab workspace
disp('Enter filename of machine parameter file without .m')
disp('Example: psph')
setX = input('Input machine parameter filename > ','s')% string s
eval(setX); % evaluate MATLAB command

% Calculation of torque speed curve
Vqs = Vrated + j*0; % rms phasor voltage of main wdg
Vpds = Nq2Nd*(Vrated + j*0);% rms aux wdg voltage referred to main
wdg
T = (1/sqrt(2))*[ 1 -j; 1 j ]; % transformation
V12 = T*[Vqs; Vpds];% transforming  qsds to sequence

disp('Select with or without capacitor option')
```

```
opt_cap = menu('Machine type? ','No capacitor','With start capacitor only','With start and run capacitor')
if (opt_cap == 1) % Split-phase machine, no capacitor
disp(' Split-phase machine')
zpcstart = 0 +j*eps; % zcrun referred to main wdg
zpcrun = 0 +j*eps; % zcrun referred to main wdg
zC = zpcstart;
Capstart = 0; % set flag
Caprun = 0; % set flag
wrswbywb = we; % cutoff speed to disconnect start cpacitor
end % if
if (opt_cap == 2) % Capacitor-start machine
disp(' Capacitor-start machine')
zpcstart = (Nq2Nd^2)*zcstart; % zcrun referred to main wdg
zpcrun = 0 +j*eps; % zcrun referred to main wdg
zC = zpcstart;
Capstart = 1; % set flag
Caprun = 0; % set flag
wrswbywb = 0.75; % rotor speed to disconnect start cpacitor
end % if
if (opt_cap == 3) % Capacitor-run machine
disp(' Capacitor-run machine')
zpcstart = (Nq2Nd^2)*zcstart; % zcrun referred to main wdg
zpcrun = (Nq2Nd^2)*zcrun; % zcrun referred to main wdg
zC = zpcrun;
Capstart = 0; % set flag
Caprun = 1; % set flag
wrswbywb = 0.75; % rotor speed to changeover from start to run
end % if

Rcrun = real(zpcrun); % referred resistance of run capacitor
Xcrun = imag(zpcrun); % referred reactance of run capacitor
Crun = -1/(wb*Xcrun); % referred capacitance of run capacitor
Rcstart = real(zpcstart); % referred resistance of start capacitor
Xcstart = imag(zpcstart); % referred reactance of run capacitor
Cstart = -1/(wb*Xcstart); % referred capacitance of start capacitor

% network parameters of positive and negative sequence circuit
```

```
zqs = rqs + j*xlqs; % self impedance of main wdg
zcross = 0.5*(rpds + real(zC) - rqs) + j*0.5*(xplds + imag(zC) - xlqs);

%set up vector of slip values
s = (1:-0.02:0);
N=length(s);

for n=1:N
s1 = s(n); % positive sequence slip
s2 = 2-s(n); % negative sequence slip
wr(n)=2*we*(1-s1)/P; % rotor speed in mechanical rad/sec
if abs(s1) < eps; s1 = eps; end;
zp1r = rpr/s1 + j*xplr;
z1s= j*xmq*zp1r/(zp1r + j*xmq);
if abs(s2)< eps; s2 = eps; end;
zp2r = rpr/s2 + j*xplr;
z2s= j*xmq*zp2r/(zp2r + j*xmq);
z11 = zqs + z1s + zcross;
z22 = zqs + z2s + zcross;
zmat = [ z11 -zcross; -zcross z22 ];
I12 = inv(zmat)*V12;
I1s = I12(1);
I2s = I12(2);
Iqd = inv(T)*[I1s; I2s];
Sin =[Vqs Vpds]*conj(Iqd);
Pin = real(Sin);
angIq(n) =angle(Iqd(1))*180/pi;
angId(n) =angle(Iqd(2))*180/pi;
magIq(n) =abs(Iqd(1));
magId(n) =abs(Iqd(2));
Ip1r = -j*xmq*I1s/(zp1r + j*xmq);
Ip2r = -j*xmq*I2s/(zp2r + j*xmq);
Tavg(n)=(P/(2*we))*(abs(Ip1r)^2*rpr/s1 - abs(Ip2r)^2*rpr/s2);
Pavg(n)=Tavg(n)*wr(n);
if abs(Pin) < eps; Pin = eps; end;
eff(n)=100*Pavg(n)/Pin;
end % n for loop
```

```
N=size(wr);
subplot(3,2,1)
plot(wr,Tavg,'-')
xlabel('Rotor speed in rad/sec')
ylabel('Torque in Nm')
subplot(3,2,2)
plot(wr,Pavg,'-')
xlabel('Rotor speed in rad/sec')
ylabel('Developed power in Watts')
subplot(3,2,3)
plot(wr,magIq,'-')
xlabel('Rotor speed in rad/sec')
ylabel('|Iqs| in A')
subplot(3,2,4)
plot(wr,magId,'-')
xlabel('Rotor speed in rad/sec')
ylabel('|Ipds| in A')
subplot(3,2,5)
plot(wr,eff,'-')
xlabel('Rotor speed in rad/sec')
ylabel('Efficiency in percent')
subplot(3,2,6)
plot(wr,angIq,'-')
hold on
plot(wr,angId,'-.')
xlabel('Rotor speed in rad/sec')
ylabel('Iqs and Ipds angle in degree')
hold off

disp('Displaying steady-state characteristics ')
fprintf('Referred capacitor impedance is %.4g %.4gj Ohms\n', real(zC),
imag(zC))
disp('type "return" to proceed on with simulation');
keyboard

% Transfer to keyboard for simulation
disp('Select loading during run up')
opt_load = menu('Loading? ','No-load','With step changes in loading')
```

```
% setting all initial conditions in SIMULINK simulation to zero
Psiqso = 0;
Psipdso = 0;
Psipqro = 0;
Psipdro = 0;
wrbywbo = 0; % initial pu rotor speed

% set up repeating sequence Tmech signal
if (opt_load == 1) % No-load
tstop = 2; % simulation run time
tmech_time =[0 tstop];
tmech_value =[0 0];
end
if (opt_load == 2) % Step changes in loading
tstop = 2.5; % simulation run time
tmech_time =[0 1.5 1.5 1.75 1.75 2.0 2.0 2.25 2.25 2.5];
tmech_value =[0 0 -Tb -Tb -Tb/2 -Tb/2 -Tb -Tb 0 0 ];
end
disp('Set for simulation to start from standstill and ')
disp('load cycling at fixed frequency,')
disp('return for plots after simulation by typing '' return''');
keyboard

% Convert referred values back to actual
Vds = y(:,3)/Nq2Nd;
Ids = y(:,8)*Nq2Nd;
Vcap = y(:,4)/Nq2Nd;
Psids = y(:,7)/Nq2Nd;
disp('Plot results in two figure windows')
h1=gcf;
subplot(5,1,1)
plot(y(:,1),y(:,2),'-')
ylabel('Vqs in V')
subplot(5,1,2)
plot(y(:,1),Vds,'-')
ylabel('Vds in V')
subplot(5,1,3)
```

```
plot(y(:,1),y(:,9),'-')
axis([-inf inf -1 1])
ylabel('Tmech in Nm')
subplot(5,1,4)
plot(y(:,1),y(:,10),'-')
ylabel('Tem in Nm')
subplot(5,1,5)
plot(y(:,1),y(:,11),'-')
xlabel('Time in sec')
ylabel('wr/wb in pu')
h2=figure;
subplot(5,1,1)
plot(y(:,1),Vcap,'-')
ylabel('Vcap in V')
subplot(5,1,2)
plot(y(:,1),y(:,5),'-')
ylabel('Psiqs in V')
subplot(5,1,3)
plot(y(:,1),y(:,6),'-')
ylabel('Iqs in A')
subplot(5,1,4)
plot(y(:,1),Psids,'-')
ylabel('Psids in V')
subplot(5,1,5)
plot(y(:,1),Ids,'-')
xlabel('Time in sec')
ylabel('Ids in A')
disp('Save plots in Figs. 1, and 2')
disp('before typing return to exit');
keyboard;
close(h2);
```

الملف (Singleph.m)

```
% Parameters of single-phase induction motor.
Sb = 186.5; % 1/4 hp rating in VA
Prated = 186.5;  % 1/4 hp output power in W
Vrated = 110;    % rated rms voltage in V
```

```
P = 4;          % number of poles
frated = 50; % rated frequency in Hz
wb = 2*pi*frated;% base electrical frequency
we = wb;
wbm = 2*wb/P; % base mechanical frequency
Tb = Sb/wbm;   % base torque
Zb = Vrated*Vrated/Sb;%base impedance in ohms
Vm = Vrated*sqrt(2);    % magnitude of phase voltage
Vb = Vm; % base rms voltage
Tfactor = P/(2*wb); % torque expression coefficient

% 1/4 hp, 4 pole, 110 volts capacitor start, capacitor run,
% single-phase induction motor parameters in engineering units from
%
%

Nq2Nd = 1/1.18;     % Nqs/Nds main to aux wdg turns ratio
rqs = 2.02;  % main wdg resistance
xlqs = 2.79; % main leakage reactance
rds = 7.14;  % aux wdg resistance
xlds = 3.22; % aux leakage reactance
rpds=(Nq2Nd^2)*rds;% aux wdg resistance referred to main wdg
xplds=(Nq2Nd^2)*xlds;% aux wdg leakage reactance referred to main
wdg
xplr = 2.12;      % rotor leakage reactance referred to main wdg
rpr = 4.12;  % rotor wdg resistance referred to main wdg
xmq = 66.8;% magnetizing reactance referred to main wdg
xMq = 1/(1/xmq + 1/xlqs + 1/xplr);
xMd = 1/(1/xmq + 1/xplds + 1/xplr);
J = 1.46e-2; % rotor inertia in kg m2
H = J*wbm*wbm/(2*Sb); % rotor inertia constant in secs.
Domega = 0; % rotor damping coefficent

zcstart = 3 - j*14.5; % starting capacitor in Ohms
zcrun = 9 - j*172; % running capacitor in Ohms
```

wrsw = 0.75*wb; % rotor speed to change over from start to run in rev/min*

* تاريخ ورود البحث إلى مجلة جامعة دمشق / / 2003