The simulation part is implement the stationary and synchronous frame predictive current control (PCC) scheme for two-level voltage source converter (2L-VSC) feeding an inductive-resistive(RL)load.'

```
%% MATLAB Commands
clc, pack,  close all, warning off
format long
%% Parameters
Ts          = 20e-6;
Tsim        = 2e-6;
Vdc         = 350;
Cdc         = 1000e-6;
Li          = 10e-3;
ri          = 0.1;
Ro          = 12;
Fo          = 60;
Wo          = 2*pi*Fo;
%% Continuous-Time Model
A_ct        = [-(ri+Ro)/Li, Wo; -Wo, -(ri+Ro)/Li];
B_ct        = 1/Li;
%% Discrete-Time Model by Forward Euler Approximation
Phi_dt      = eye(size(A_ct))+(A_ct*Ts);
Gamma_dt    = B_ct*Ts;
%% Definition of Constants for .h File used in S-Function
fid = fopen('Parameters.h','w');
fprintf(fid,'#define\tPhi11\t\t%3.14f\n',Phi_dt(1,1));
fprintf(fid,'#define\tPhi12\t\t%3.14f\n',Phi_dt(1,2));
fprintf(fid,'#define\tPhi21\t\t%3.14f\n',Phi_dt(2,1));
fprintf(fid,'#define\tPhi22\t\t%3.14f\n',Phi_dt(2,2));
fprintf(fid,'#define\tGamma\t\t%3.14f\n',Gamma_dt);
fprintf(fid,'\n');
fclose(fid);
```

Figure 1: Initialization file

The initialization file provides parameters to the model file. When the parameters are changed, the initialization should be run.

```
#define Phi11        0.97580000000000
#define Phi12        0.00753982236862
#define Phi21        -0.00753982236862
#define Phi22        0.97580000000000
#define Gamma        0.00200000000000
```

Figure 2: Discrete –time parameters file

This file is updated every time the initialization file compiled.

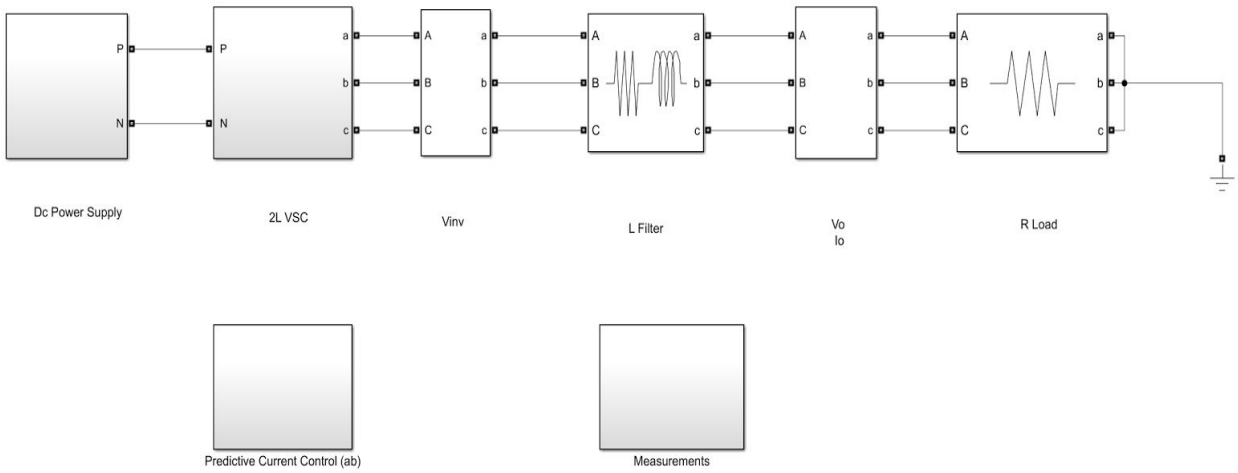


Figure 3. Simulink model for PCC of 2L-VSC with *RL* load.

The overall Simulink model for the PCC scheme is shown in Figure 3. The first row corresponds to the power circuit. The power blocks are implemented using SimPowerSystems toolbox. The second row contains PCC and measurements subsystems.

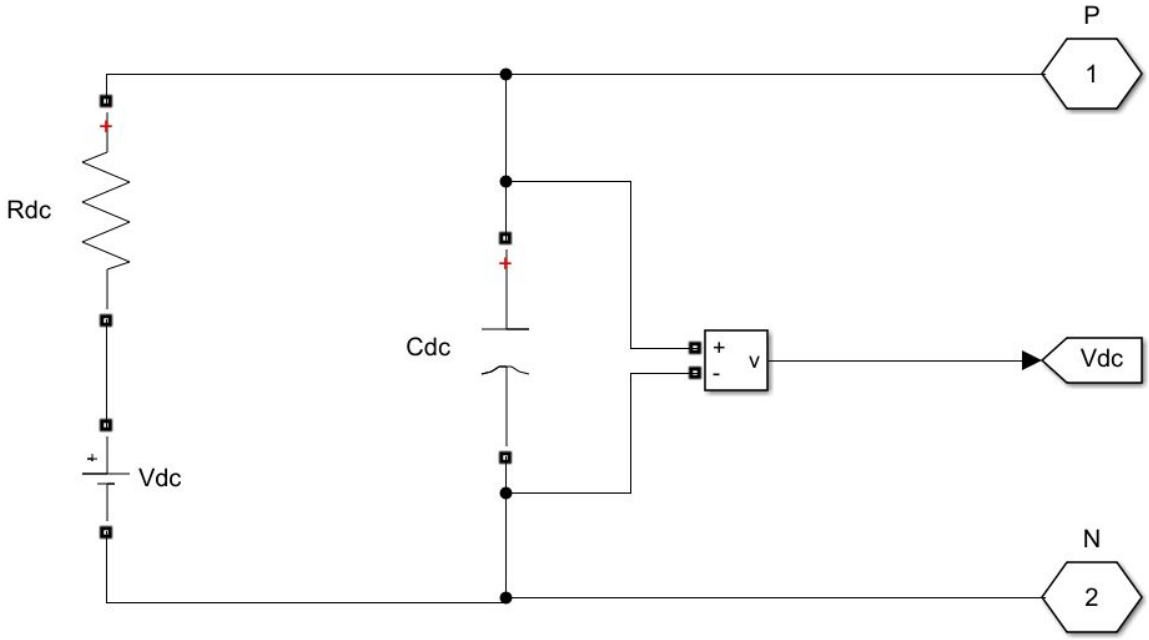


Figure 4.Simulink model for DC power supply subsystem.

The DC power supply subsystem is shown in Figure4. It contains a DC supply in parallel with a DC capacitor. The line between supply and DC capacitor is represented by a small resistance of 1 mΩ

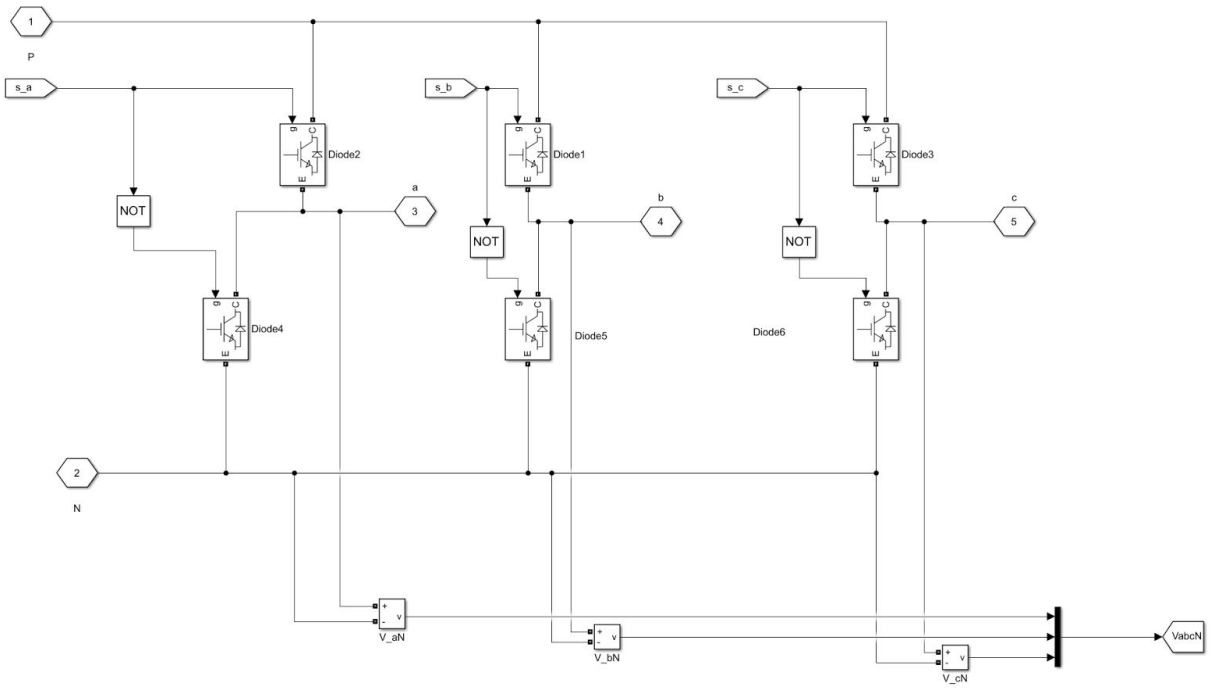


Figure 5. Simulink model for 2L-VSC.

The power circuit of 2L-VSC is shown in Figure 5. It consists of 6 IGBTs with two IGBTs per phase. The switching signals for the lower-leg IGBTs are.The switching signals for the lower-leg IGBTs are complementary to the corresponding upper-leg switching signals. The measurement of inverter output voltages with respect to the negative DC bus is also shown in subsystem.

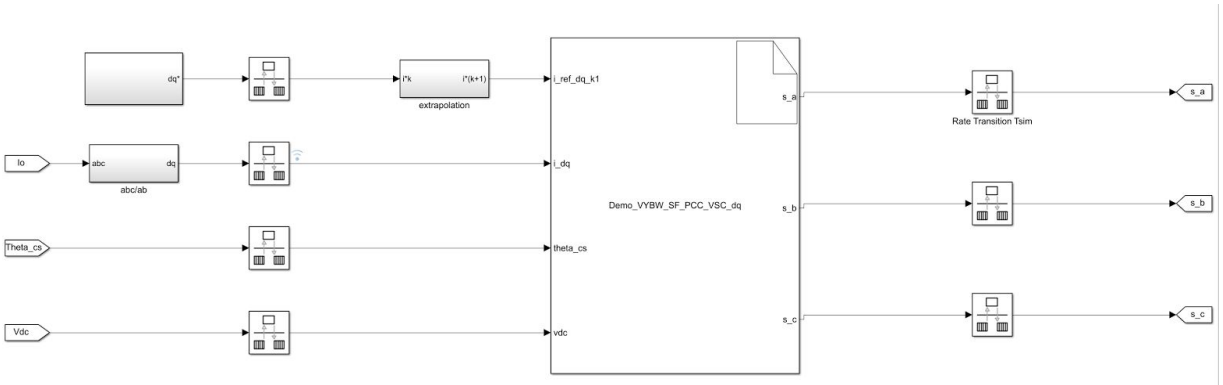
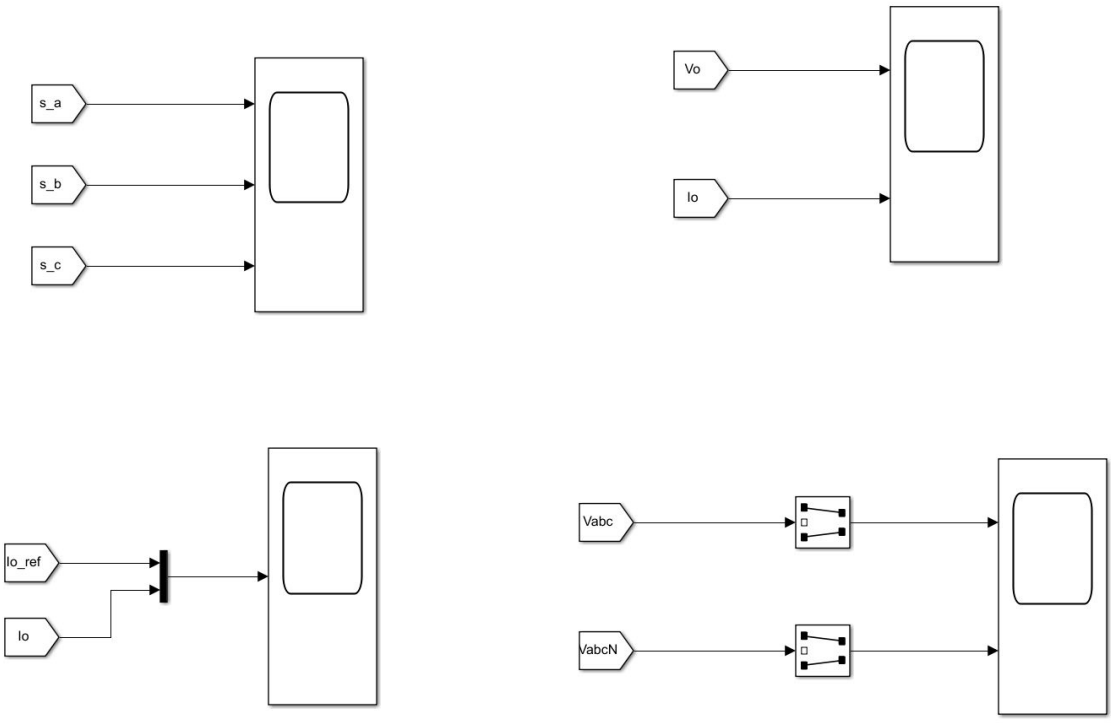


Figure 6. Simulink model for PCC scheme.

The predictive current control subsystem is shown in Figure 6. The subsystem mainly consists of following:

1. Measurement of feedback DC-link voltage Vdc(k).
2. Measurement of feedback three-phase load currents, ia(k), ib(k), ic(k)
3. Transformation of natural frame load currents ia(k), ib(k), ic(k) to stationary frame load currents ia(k), ib(k)¨
4. Extrapolation of reference currents to (k+1) sampling instant using the "Extrapolation" subsystem. The (k+1) sampling instant reference currents are obtained by the Lagrange extrapolation as shown above.



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