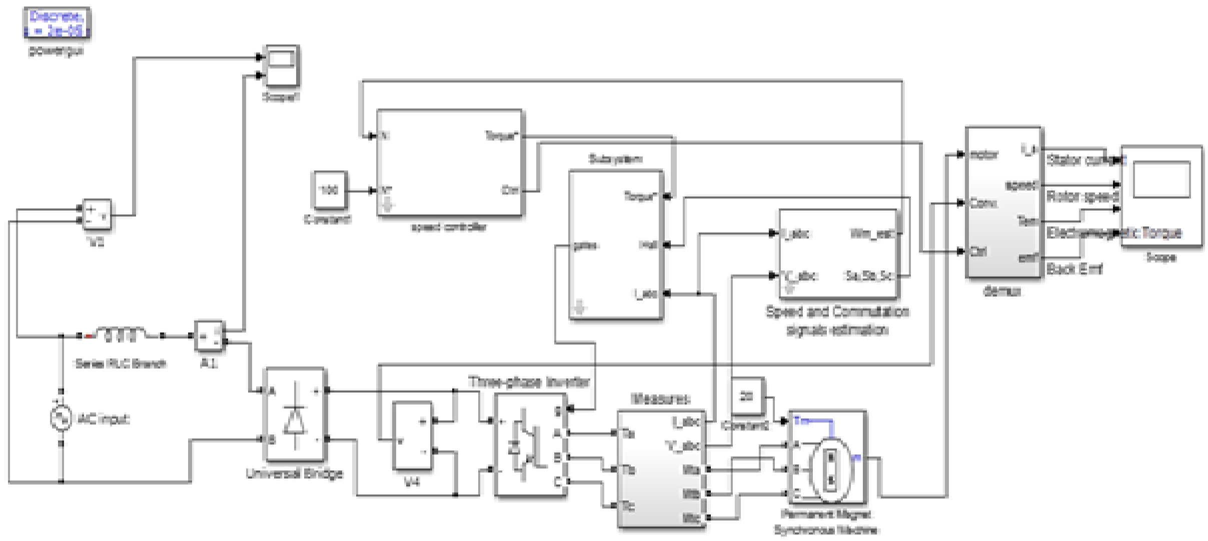

Figure 5: Sensorless BLDC MATLAB/Simulink model

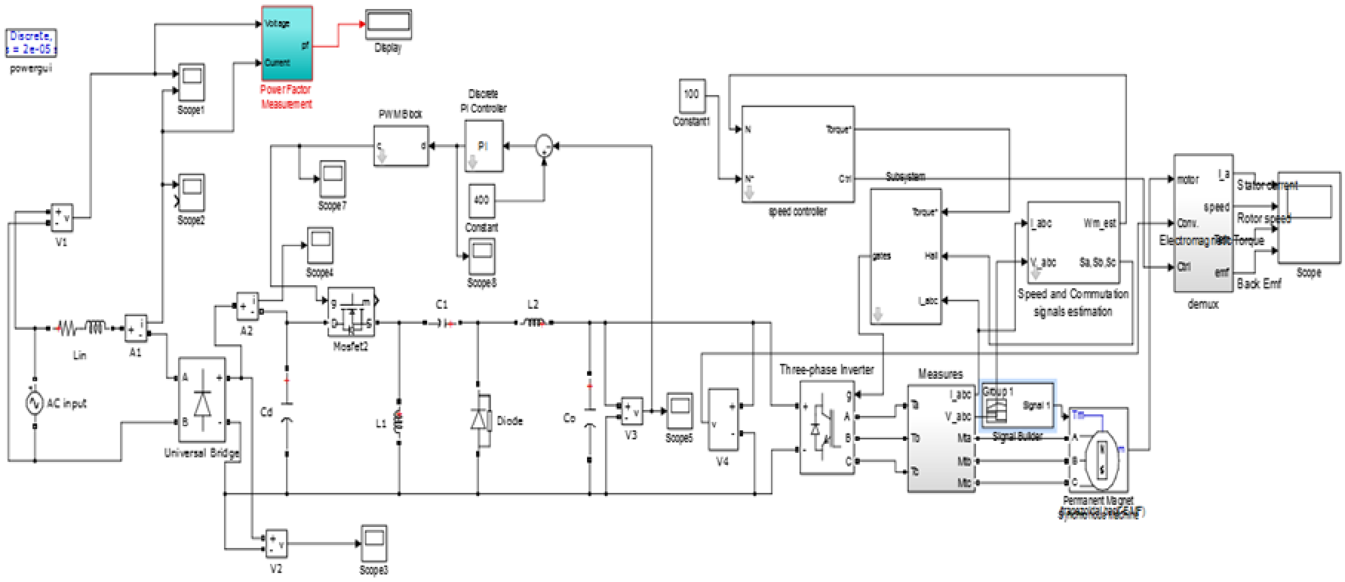

Figure 6: MATLAB model of zeta converter fed BLDC motor drive

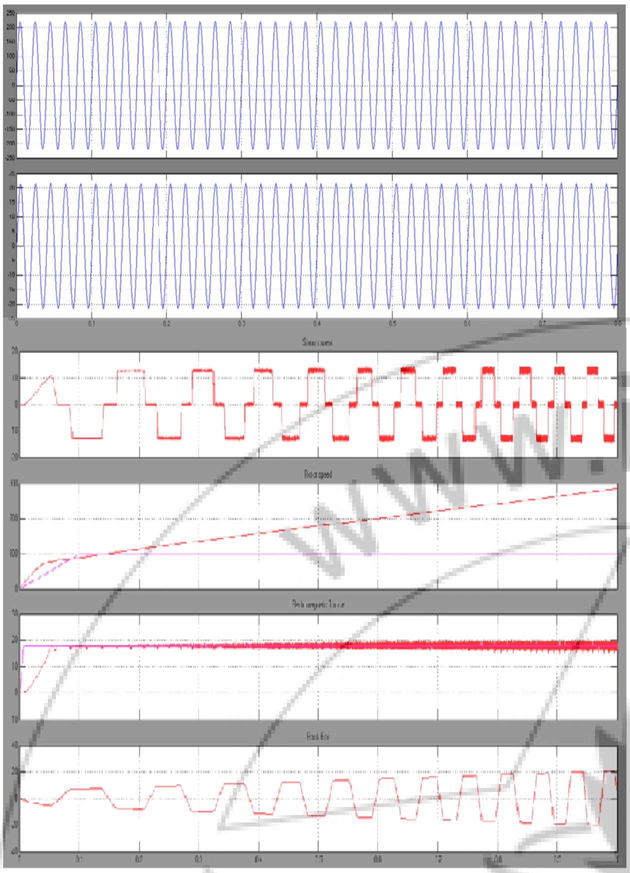

Figure 7: Steady state performance of Zeta converter fed BLDC motor drive working in discontinuous conduction mode:supply voltage,supply current,stator current,rotor speed,torque,back emf.

Table 1: Power Quality Parameters With Input Ac Voltage Variation For Zeta Converter Fed Bldc Motor Drive

Vs	THD of Is	Is	PF	Crest factor
170	1	3.6	0.9888	1.4142
180	1.3	3.5	0.9889	1.4149
190	1.7	3.2	0.9891	1.4193
200	1.9	3	0.9894	1.4172
210	2.1	2.8	0.9893	1.4165
220	2.8	2.7	0.9897	1.4132
230	2.9	2.55	0.9901	1.4155
240	3	2.35	0.9906	1.4169
250	3.1	2.25	0.9912	1.4178
260	3.2	2.2	0.9915	1.4188
270	3.5	2	0.9921	1.4198

Fig. 9 shows the harmonic spectrum of the supply current at near rated speed and the THD obtained as 3.8% which is well below the international PQ standards limits. The performance of BLDC motor drive on the variation of supply voltage is tabulated in Table I to demonstrate that the proposed PFC converter operates satisfactorily in the practical situation. The THD of supply current is controlled within 5% with near unity power factor operation.

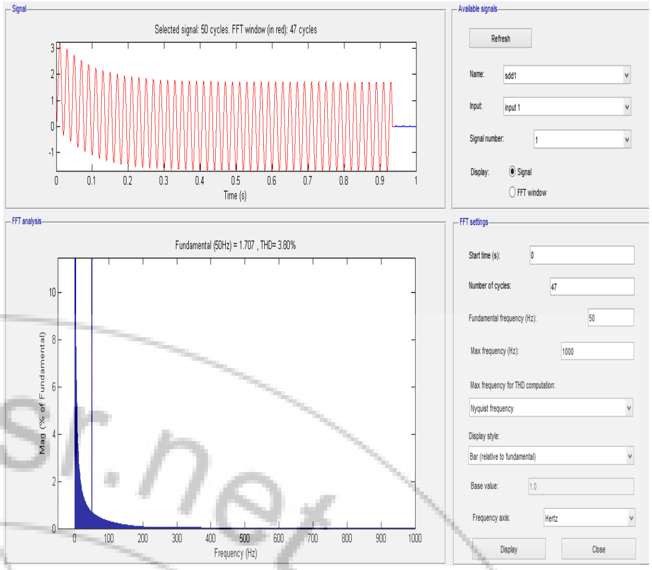

Figure 8: The harmonic spectrum of the supply current at near rated speed

7. Conclusion and Future Scope

A simple control using a voltage follower approach has been used for voltage control and power factor correction of a PFC Zeta converter fed BLDC motor drive. A novel scheme of speed control using a single voltage sensor has been proposed for a fan load. A sensorless operation for the further reduction of position sensor has been used. A single stage PFC converter system has been designed and validated for the speed control with improved power quality at the AC mains for a wide range of speed. The performance of the proposed drive system has also been evaluated for varying input AC voltages and found satisfactory. The power quality indices for the speed control and supply voltage variation have been obtained within the limits by International power quality standard IEC 61000-3-2. The proposed drive system has been found a suitable candidate among various adjustable speed drives for many low power applications. As a future expansion, we will be going for a hardware implementation of the work.

8. Appendix

BLDC Motor Rating: 4 pole, Prated (Rated Power) = 424.11W, Trated (Rated Torque) = 1.35 Nm, ωrated (Rated Speed) = 3000 rpm, Kb (Back EMF Constant) = 51 V/krpm, Kt (Torque Constant) = 0.49 Nm/A, Rph (Phase Resistance) = 7.20Ω, L (Phase Inductance) = 4.77 mH, J (Moment of Inertia) = 0.37 kg-cm2.

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