Automatic Reactive Power Control of Isolated Wind-Diesel Hybrid Power Systems Using Matlab/Simulink

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- **This paper presents reactive power control of isolated wind-diesel hybrid power system for realistic load disturbance using simulink.**

- **The mathematical model of the system based on simulink is developed.**

- **Reactive power control performance is compared using three different types of Static VAR Compensator (SVC) models.**

- A wind-diesel hybrid system is considered in which the DG set acts as a local grid for the wind energy conversion system.

- Diesel generator set is considered to be connected to synchronous generator and wind system on induction generator.

- The system has a SVC to provide the required reactive power in addition to the reactive power generated by the synchronous generator.

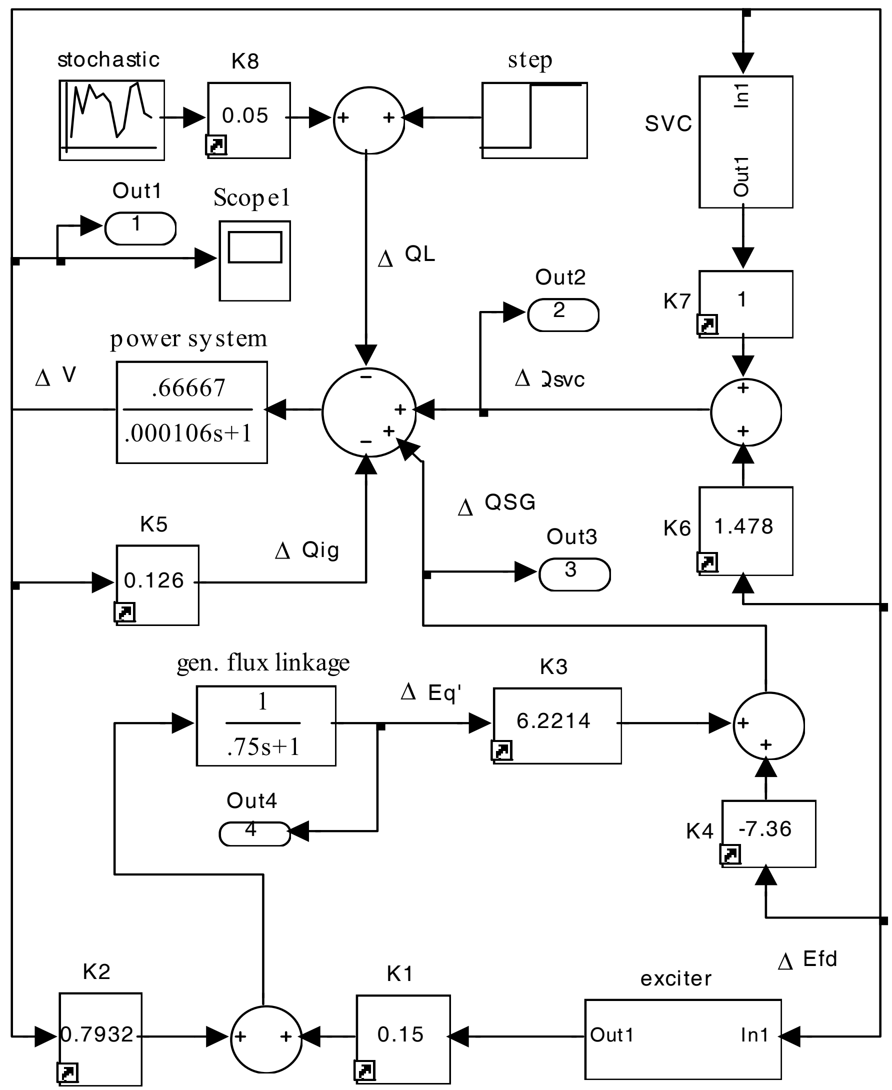

Fig. 5.3 Simulation block diagram of wind - diesel autonomous hybrid power system with constant slip for step +Stochastic disturbance

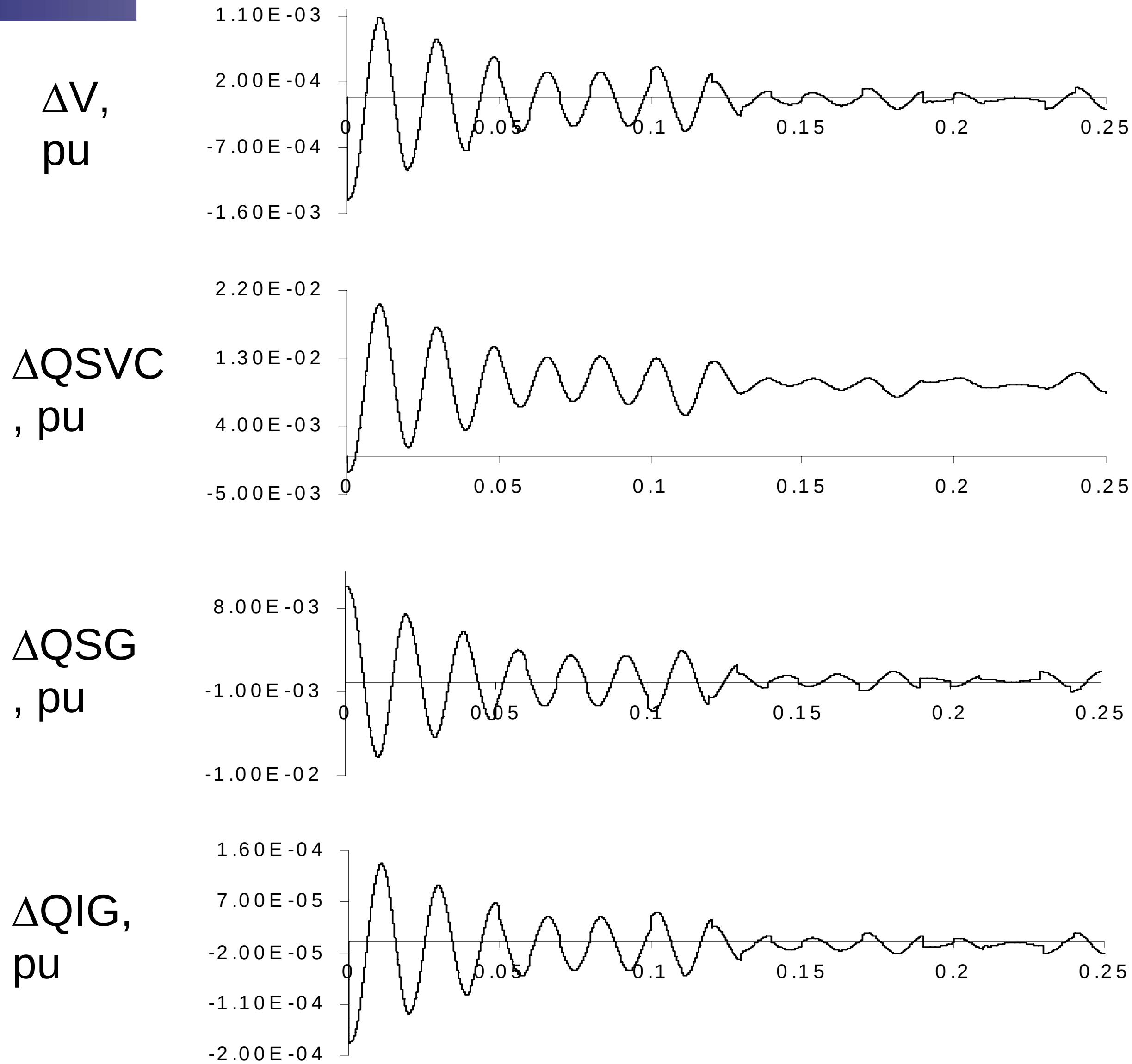

Fig. 2 Dynamic responses of the wind-diesel autonomous hybrid power system with SVC type-I, with 'dist. a' for 1% step increase in reactive power load

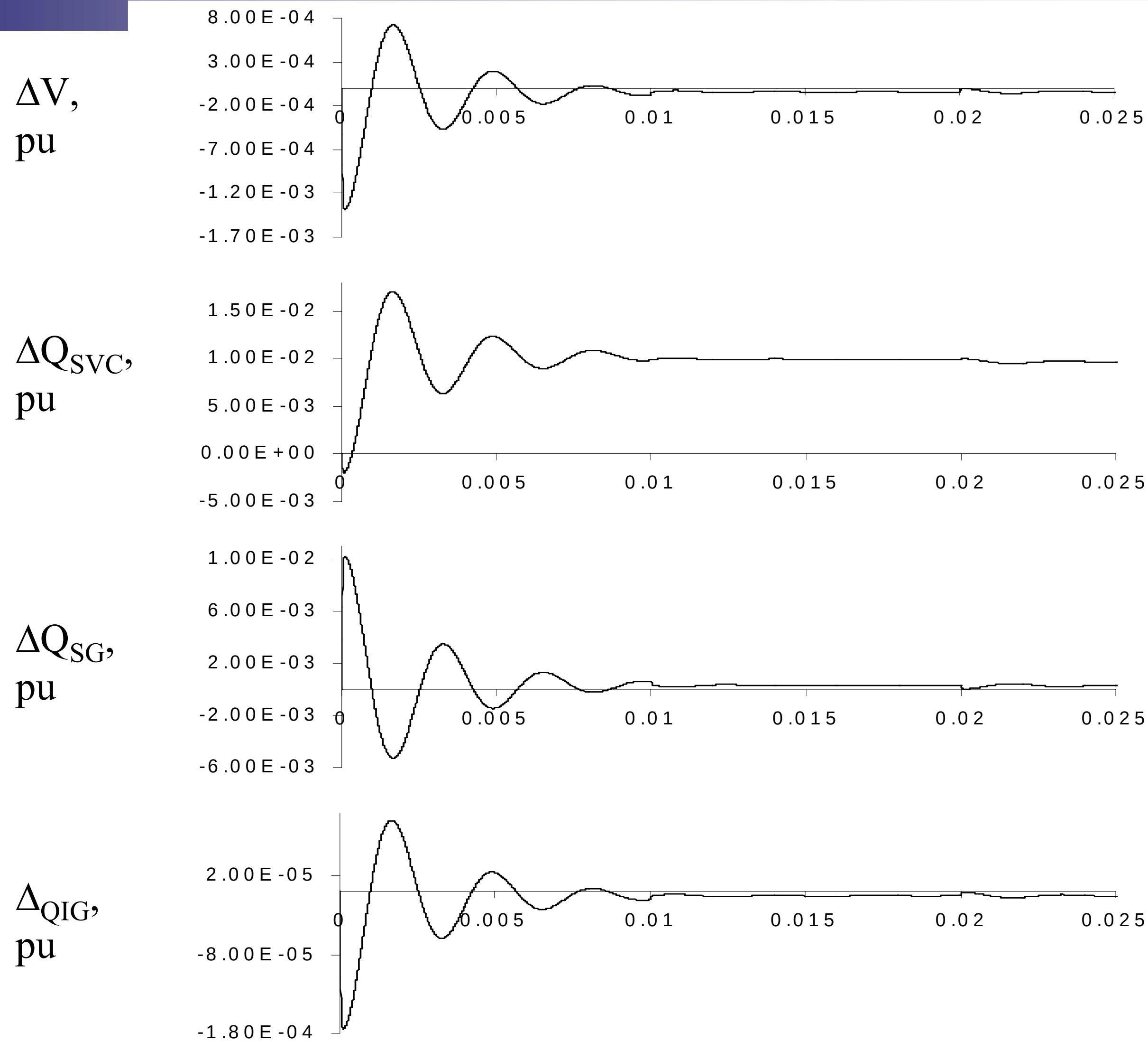

Fig. 3 Dynamic responses of the wind-diesel autonomous hybrid power system with SVC type-II, with 'dist. a' for 1% step increase in reactive power load

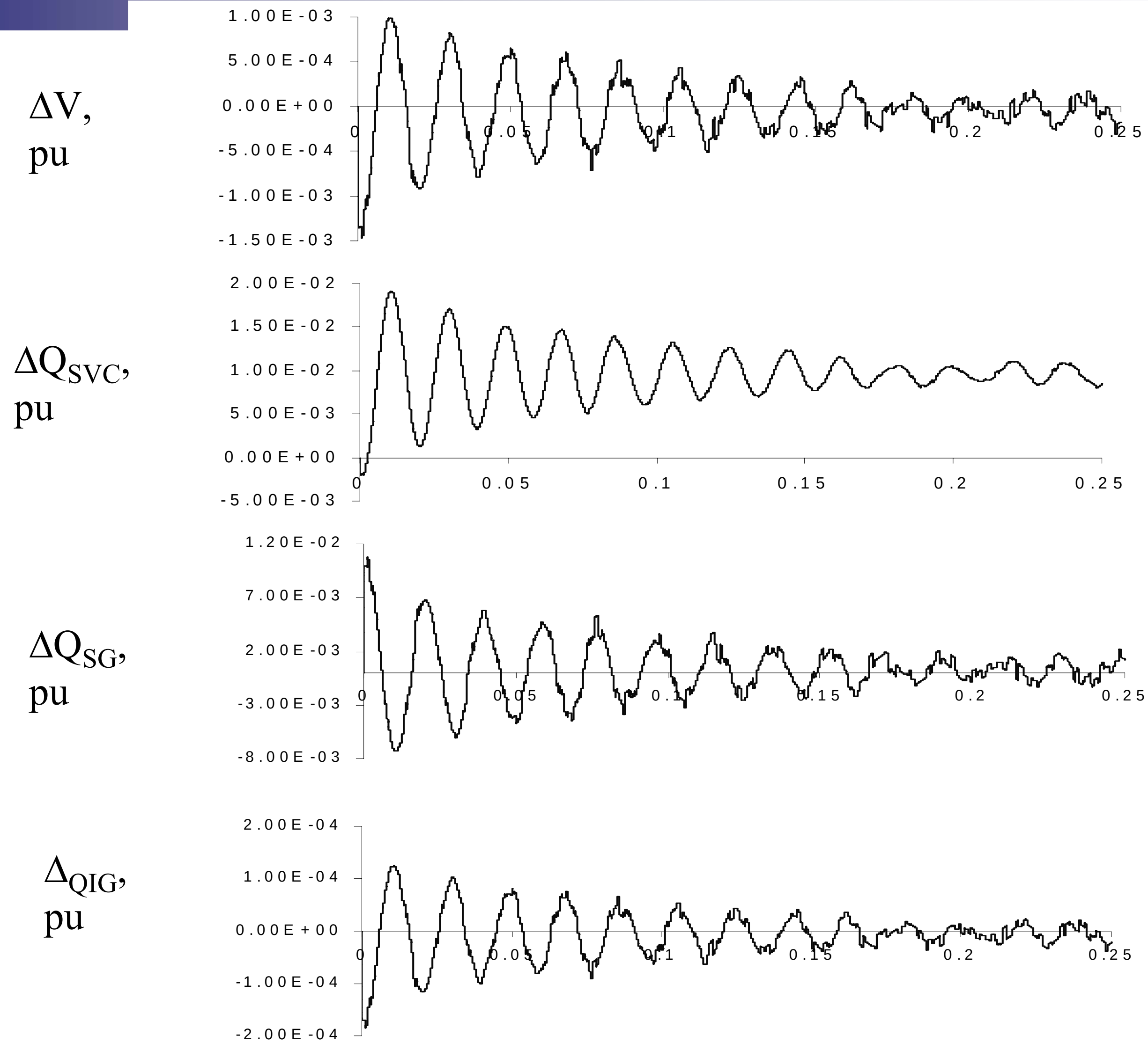

Fig. 4 Dynamic responses of the wind-diesel autonomous hybrid power system with SVC type-III, with 'dist. a' for 1% step increase in reactive power load

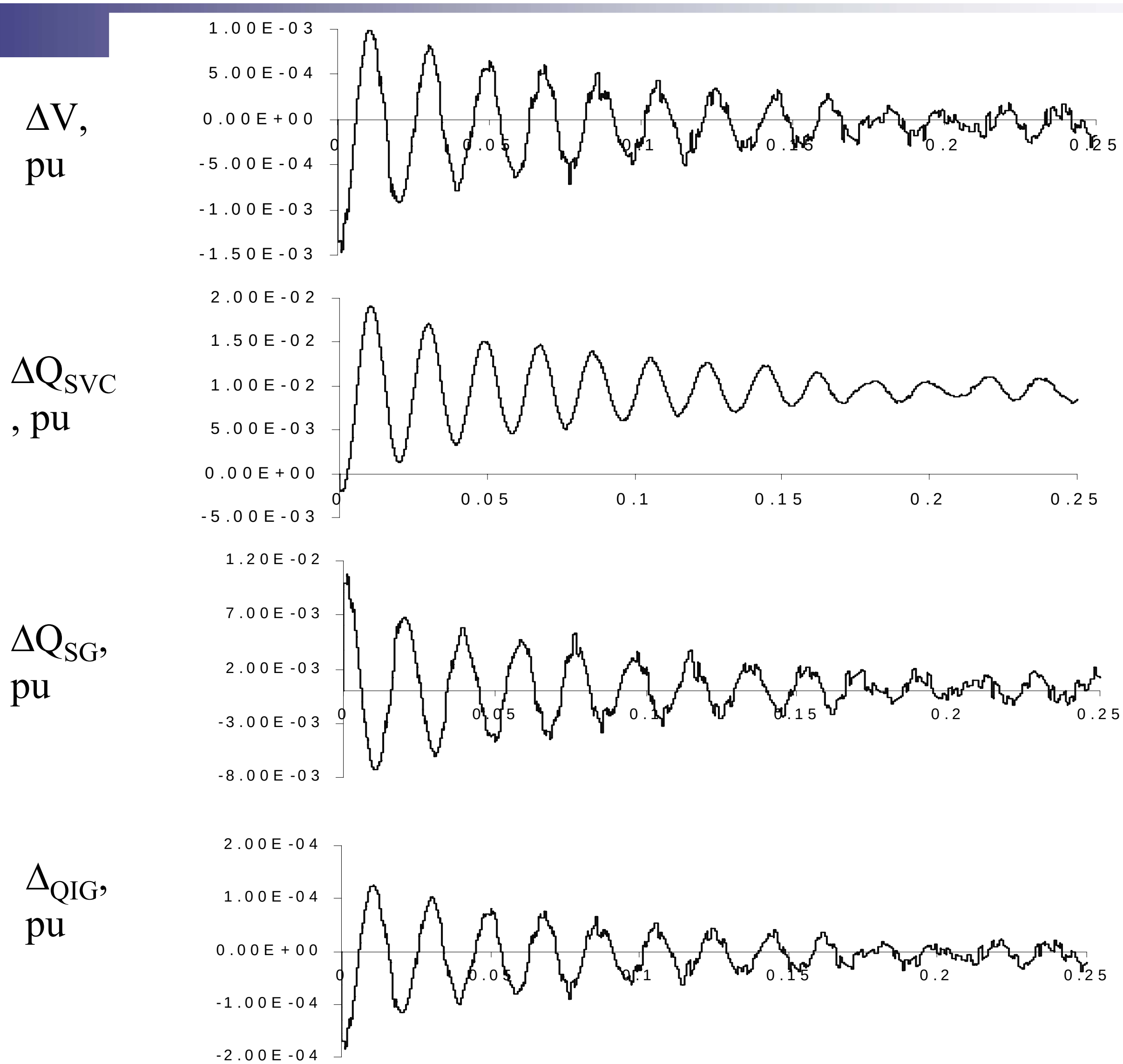

Fig. 5 Dynamic responses of the wind-diesel autonomous hybrid power system with SVC type-I, with 'dist. b' for 1% step increase in reactive power load

Table I The peak deviations of different parameters of wind-diesel hybrid system

SVC type and disturbance	ΔV	ΔQ_{SVC}	ΔQ_{IG}	ΔQ_{SG}
I and dist. a	-0.001410	0.020165	0.010372	-0.000178
II and dist. a	-0.001382	0.016452	0.010169	-0.000174
III and dist. a	-0.001387	0.017493	0.010209	-0.000175
I and dist. b	-0.001356	0.019140	0.009976	-0.000171

RESULTS

From Figs. 2 and 5 it is observed that the first peak of the swings depends upon the type of disturbance.

It is also observed that initially the synchronous generator provides the reactive power required by the load, but substantially it is met by the SVC alone and therefore the steady state value of ΔV, ΔQSG, and ΔQIG becomes zero.

It is also found from Figs. 2(b)-5(b) that the respective peak deviations are less with SVC type-II and SVC type-III as compared with SVC type-I.

The settling time is 0.015 sec. for the system responses with SVC type-II, and SVC type-III, but with SVC type-I it is 0.15 sec.

Performance of SVC type-II and type-III is better than SVC type-I in terms of first peak deviations and settling time.

CONCLUSIONS

This paper has presented the reactive power compensation study of sample wind-diesel isolated hybrid power system with three types of SVCs and two types of realistic disturbances.

The application of simulink tool for reactive power compensation of wind-diesel isolated hybrid power systems presented in this paper shows that simulink is very effective and easy for studying and comparing the performance of the systems with different types components e.g. various types of SVCs and different types of disturbances, etc.