An Effective Voltage Controller for Quasi-Z-Source Inverter-Based STATCOM With Constant DC-Link Voltage

Abstract—A quasi-Z-source inverter (qZSI) could achieve buck/boost conversion as well as dc to ac inversion in a single-stage topology, which reduces the structure cost when compared to a traditional two-stage inverter. Specifically, the buck/boost conversion was accomplished via shoot-through state which took place across all phase legs of the inverter. In this paper, instead of using traditional dual-loop-based proportional integral (PI)-P controller, a type 2 based closed-loop voltage controller with novel dc-link voltage reference algorithm was proposed to fulfill the dc-link voltage tracking control of a single-phase qZSI regardless of any loading conditions, without the need of inner inductor current loop. A dc–ac boost inverter with similar circuit parameters as a qZSI was used to verify the flexibility of the proposed controller. The dynamic and transient performances of the proposed controller were investigated to evaluate its superiority against the aforementioned conventional controller. The integrated proposed controller and qZSI topology was then employed in static synchronous compensator application to perform reactive power compensation at the point of common coupling. The effectiveness of the proposed approach was verified through both simulation and experimental studies.

CONCLUSION

A voltage controller based on type 2 compensator incorporating a novel dc-link voltage reference algorithm was proposed for single-phase dc–ac boost inverter and qZSI topologies. When compared with the traditional dual-loop-based PI-P controller, the proposed controller showed simpler design procedures to attain its control parameters without using trial and error method. In addition, the proposed controller demonstrated stability and excellent dynamic and transient performances even though qZSI was operating in discontinuous conduction mode. Furthermore,
constant qZSI dc-link voltage was achieved by the proposed dc-link voltage reference algorithm regardless of any loading conditions.

SOFTWARE:
- MATLAB

REFERENCES

