Simple Controller for Boost Converter for Fuel Cell Applications

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Abstract

Fuel cells have become one of the most promising sources of electrical energy because of their high efficiency, low environmental impact, and modularity. However, there are some difficulties in their operation such as the inability to accept current in the reverse direction, having low output voltage that varies with age and current drawn from it, responding sluggishly to step changes in load, and limitations in overload capabilities. For these reasons, boost types DC-DC converters are often necessary to boost and regulate their voltage to provide an applicable DC power source. Although sliding mode controllers are used for these types of converters because of their robustness and stability, yet such controllers operate at very large and variable switching frequency. This introduces excessive switching losses, filter design complication, and electromagnetic interference noise. The proposed controller is a classical PI controller cascaded with phase-lead compensator. The system is analyzed and the proposed controller is designed. An experimental setup is constructed in the laboratory to verify the performance of the proposed controller. It is shown that the proposed controller is simple to implement, has good performance measures such as small settling time, slight overshoot, and very low steady-state error.

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