Individual Module Maximum Power Point Tracking for a Thermoelectric Generator Systems

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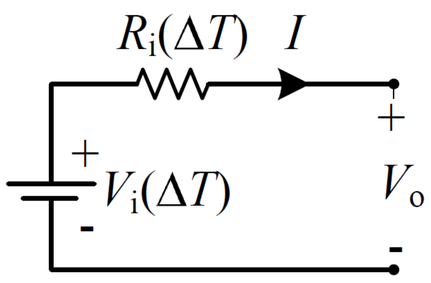
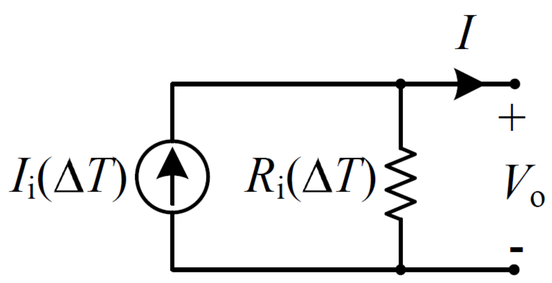
1 Introduction

Due to the varying nature of the output voltage of Thermo Electric Generator (TEG) systems a power converter is often inserted between the TEG system and the load. The power converter is operated by a Maximum Power Point Tracker (MPPT) which insures that the TEG system produces the maximum power. However, if the conditions, e.g. temperature, health, age, etc., of one or more modules are different from the other modules the full potential of the system is not reached as each module will have its own operation point of maximum power. The MPPT will therefore only find the best compromise of all modules. In order to increase the power production of the TEG system all the modules should therefore be operated at their individual Maximum Power Point (MPP).

2 TEG Modeling

The TEG modules can be modeled as Thévenin or Norton circuits. V_i [V] is the inner voltage source, I_i [A] is the inner current source and R_i [Ω] is the inner resistance.

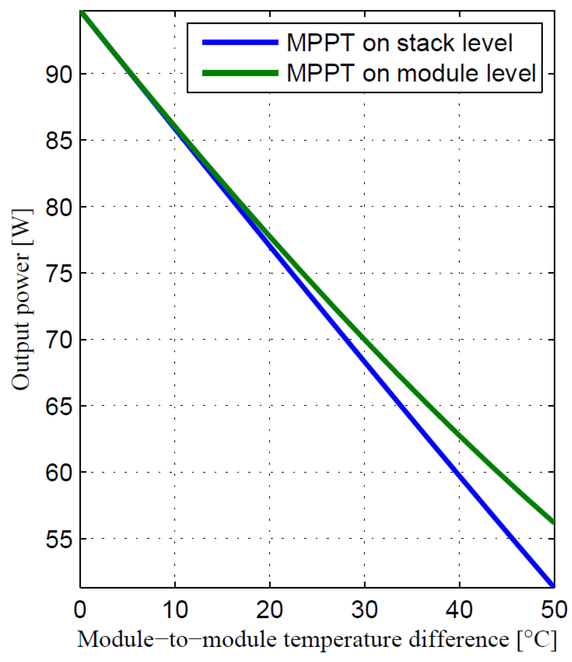


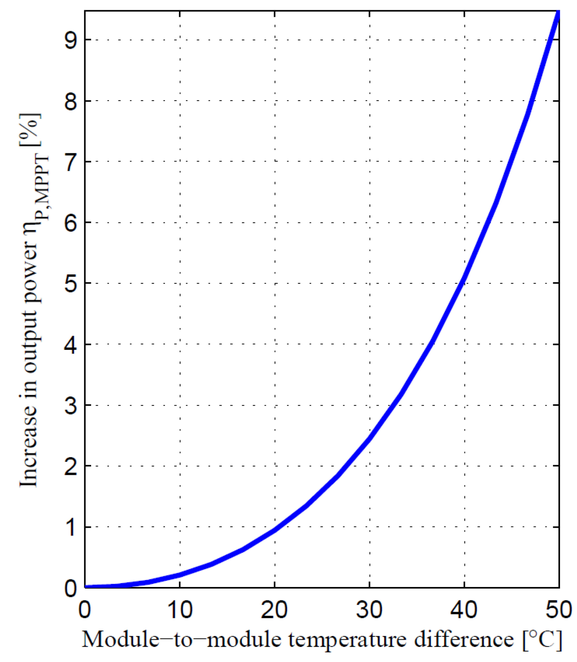


The inner voltage source, current source and resistance depends all on the temperature difference ΔT [°C] of the module.

3 Maximum Power Point

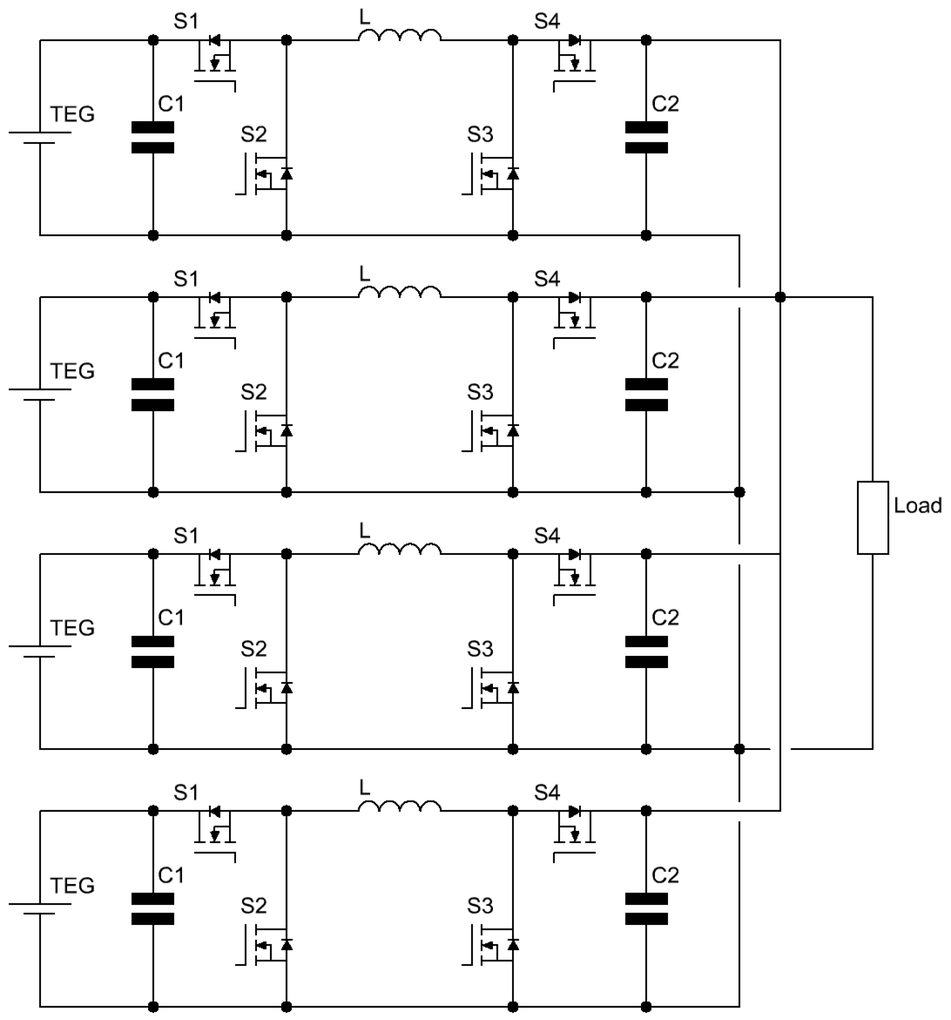
The MPP of each module depends on the temperature difference. Therefore, in order to increase the system output power each module should be operated at its MPP.

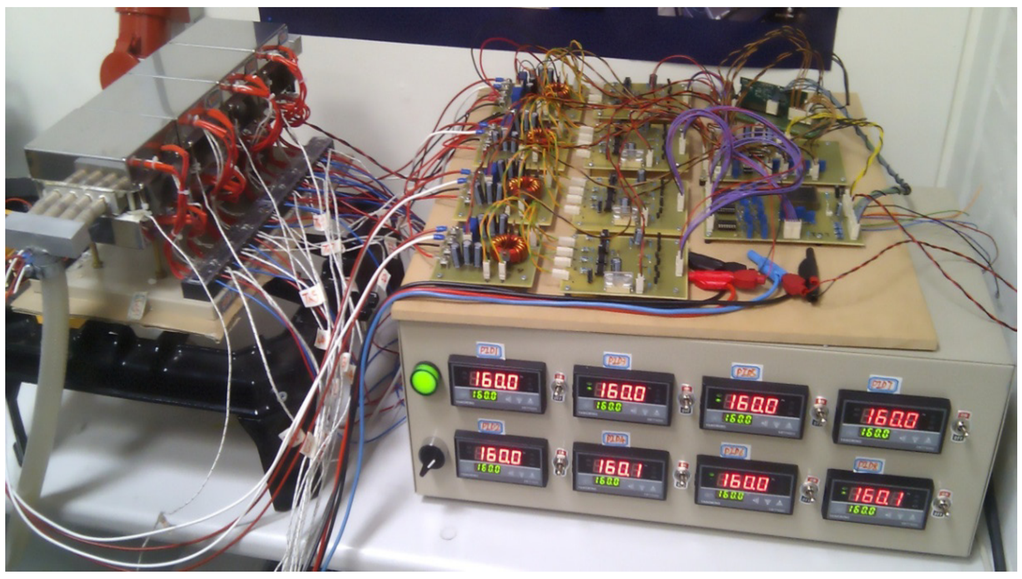




4 Implementation

Four Non-Inverting Buck-Boost converters have been built. Two TEG modules are connected in series at each converter input.





5 Conclusion

By operating each module in a TEG system on its MPP the output power can be increased by up to 9.5 % in compare to when MPPT only is applied at stack level.