Multi-Objective Optimization for Power Electronics used in Grid-Tied Energy Storage Systems

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MOTIVATION
Increased penetration of renewables and greater loads will present an opportunity for wide spread use of energy storage systems (ESS) in the future. ESS needs to be cost effective, reliable, and safe, among other objectives. Demonstration of multi-objective optimization applied to ESS is needed.

OBJECTIVE
Demonstrate multi-objective optimization using a genetic algorithm for ESS, specifically applied to a DC/AC power electronics inverter for a grid-tied Battery Energy Storage System (BESS). Develop an optimization model which consists of objective functions, decision variables, and a Pareto front of optimal non-dominating solutions.

BACKGROUND
A highly important component of the DC/AC inverter is the semiconductor switch. For this application, the IGBT switch was studied.

ANALYSIS AND RESULTS
IGBT failure rate is a function of Junction Temperature, $T_j$, which is subsequently impacted by the switching frequency, $f_{sw}$, and the thermal resistance, $R_{sink}$.

CONCLUSION
Higher switching frequencies are sensitive to cooling (changes in $R_{sink}$).