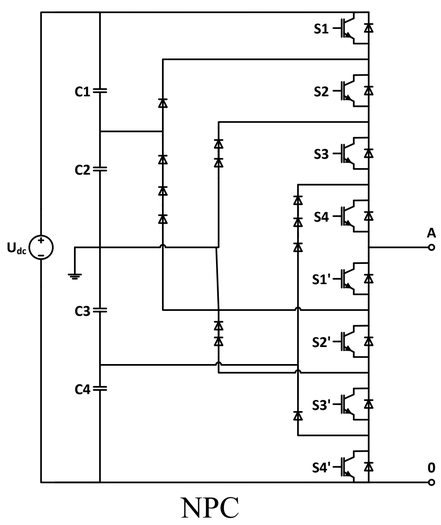
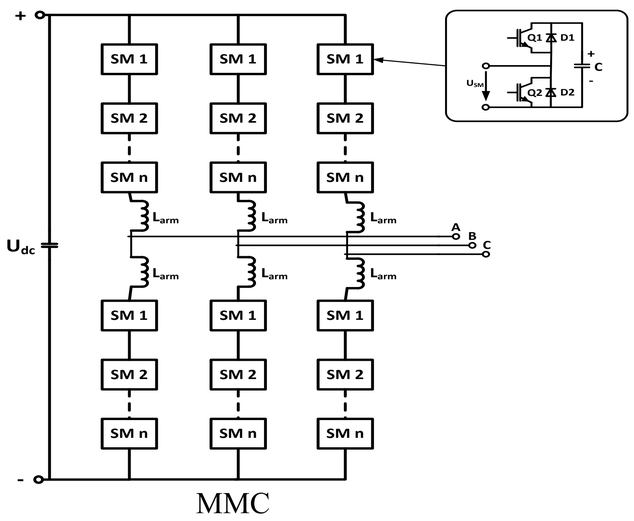
CONVERTER DESIGN FOR PUMPED-STORAGE HYDRO POWER UNIT WITH LARGE NUMBER OF RAPID START-STOPS

1 TOPOLOGY

A multilevel converter can offer a more sinusoidal output voltage compared with a traditional 2-level converter, and different multilevel topologies (NPC and MMC) have different benefits and drawbacks.



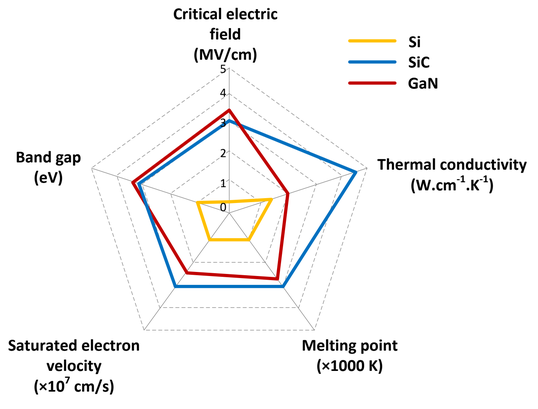
NPC

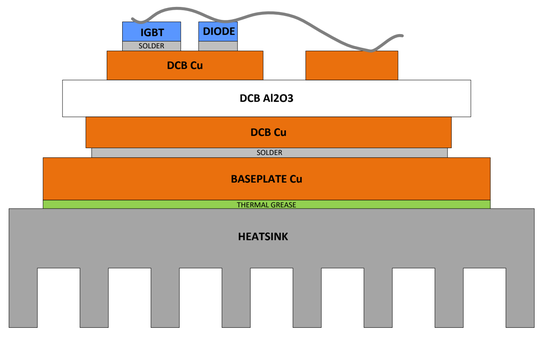


MMC

2 COMPONENTS

Wide-bandgap devices, such as **SiC** and **GaN** semiconductors, can offer an better performance compared with **silicon** based semiconductors.

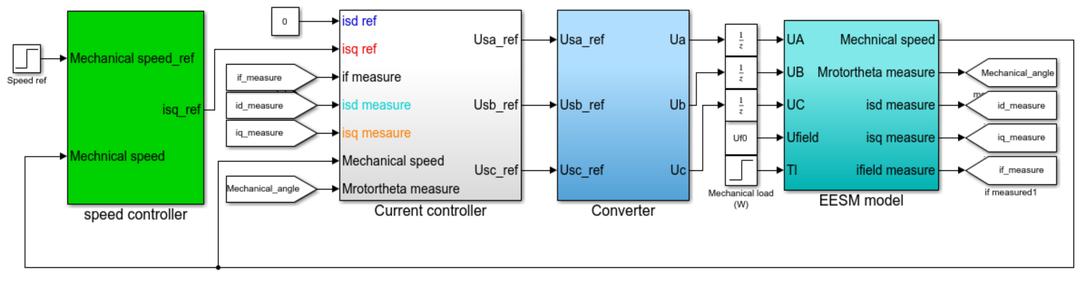




Cross-section of an IGBT module

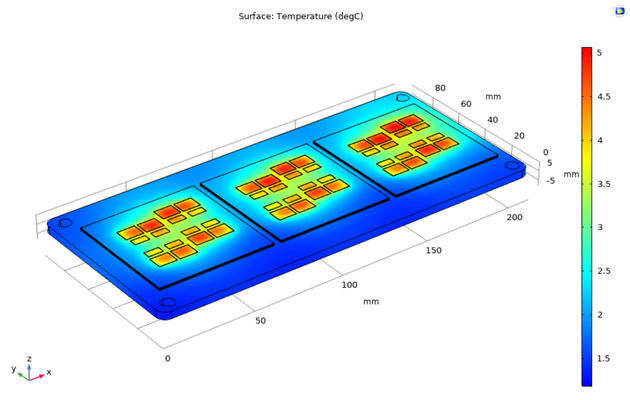
3 ELECTRICAL ANALYSIS

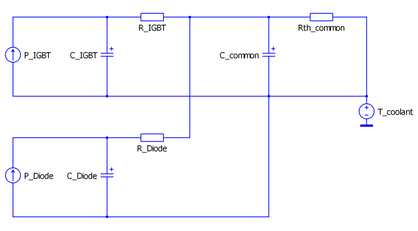
A closed-loop electrical simulation considering the speed controller, the current controller, the converter and the electrical-excited machine. Implemented in MATLAB & Simulink and PLECS.



4 THERMAL ANALYSIS

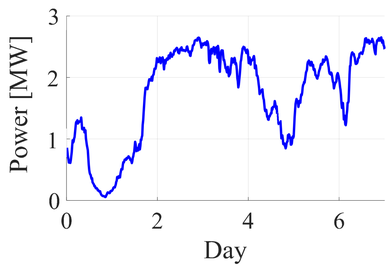
Thermal analysis is implemented in COMSOL Multiphysics within 3D space.
An lumped thermal parameters model is derived based on simulation results.

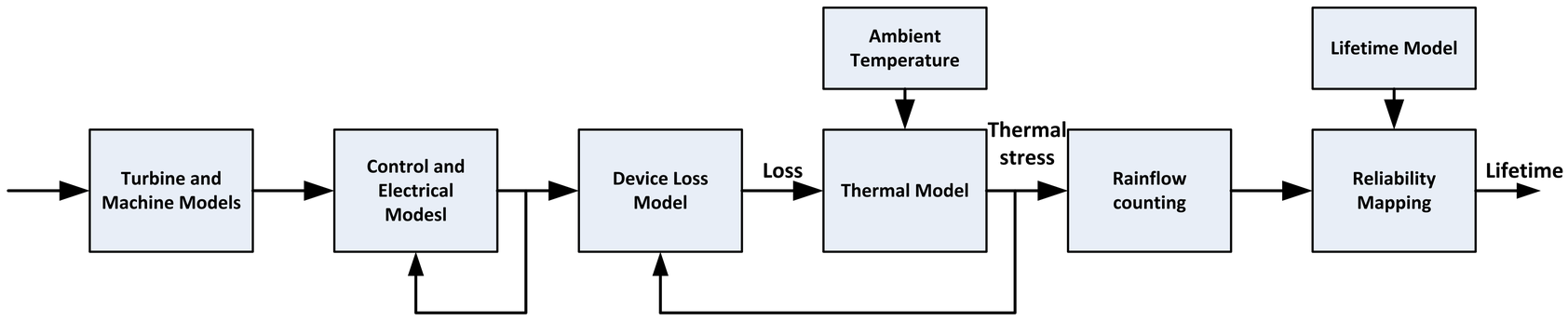




5 RELIABILITY AND LIFETIME

Based on the loading profile, an thermal stress profile (e.g. junction temperature profile) can be generated from thermal model. Lifetime consumption can be estimated based on rainflow counting method.





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