Battery Energy Storage System (BESS) with three phase Grid Integrated Inverter using 3D printed Magnetics components with Nanocrystalline soft magnetic material

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AC-DC converters for BESS integration

- BESS require AC-DC power converters for integration to the grid and provide grid services.
- High-frequency (HF) transformer integrated AC-DC power converters provide lighter and high power density solution for BESS integration to the grid eliminating the bulky line frequency transformers.
- Conventional AC-DC converters based on back to back, matrix converters and the unfolding circuit based converters have major drawbacks of either low current quality issues or voltage sag ride through capabilities which are important requirements of IEEE 1547 standard.
- To meet harmonic requirements of IEEE 1547 standard back to back and matrix AC-DC converter require large and bulky LCL filters, complicated controllers and damping degrading their power density and efficiency.
- High frequency (HF) transformer integrated AC-DC power converters provide lighter and high power density solution for BESS integration to the grid eliminating the bulky LCL filter, complicated controllers and damping degrading their performance.

What is this project about?

AC-DC MBTR Converter with Printed Nano-crystalline High Frequency (~100 kHz) Transformer

- Proposed Integrated HMC-based AC-DC stages of back to back converters that still preserve the decoupled operation of the AC-DC and DC-DC stages of the resulting AC-DC converter for BESS integration to the AC grid.
- Both AC-DC and DC-DC operate above 100 kHz relative to state of art systems where AC-DC stage operates at 20 kHz and lower frequencies.
- Natural elimination of harmonics induced by distorted grid voltage leading to elimination of the need for bulky LCL filter, complicated controllers and damping degrading their power density and efficiency.
- Soft switched high frequency AC-DC and DC-DC stage operation.

Integrated Magnetic Components and HF Transformer

- Proposed magnetic design arrangements with their dimensions.
- Equivalent electrical circuit diagram of Proposed magnetic structure.

Proposed MBTR Converter and AC Grid Harmonic Elimination

- Proposed MBTR Converter for BESS integration and AC Grid Harmonic Elimination.
- Additive Manufacturing (AM) based Printed magnetics components for DC-DC stage using FINEMET material offer tighter tolerance and enhanced higher temperature operating capability.
- Soft switched High frequency AC –DC and DC-DC stage operation.

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