

## High Frequency Rotary Transformer Used in Synchronous Motor/Generator of Flywheel Energy Storage System

**Authors :** J. Lu, H. Li, F. Cole

**Abstract :** This paper proposes a high frequency rotary transformer (HFRT) for a separately excited synchronous machine (SESM) used in a flywheel energy storage system. The SESM can eliminate and reduce rare earth permanent magnet (REPM) usage and provide a better performance in renewable energy systems. However, the major drawback of such SESM is the necessity of brushes and slip rings to supply the field current, which increases the maintenance cost and operation reliability. To overcome these problems, an HFRT integrated with SiC semiconductor devices can replace brushes and slip rings in the SESM. The proposed HFRT features a high frequency magnetic ferrite for both the stationary part as the transformer primary and the rotating part as the transformer secondary and an air gap, allowing safe operation at high rotational speeds. Hence, this rotary transformer can enable the adoption of a wound rotor synchronous machine (WRSM). The HFRT, working at over 100kHz operating frequency exhibits excellent performance of power efficiency and significant size reduction.

**Keywords :** brushes and slip rings, flywheel energy storage, high frequency rotary transformer, separately excited synchronous machine

**Conference Title :** ICEPE 2024 : International Conference on Energy and Power Engineering

**Conference Location :** Kyoto, Japan

**Conference Dates :** November 18-19, 2024