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PERFORMANCE ANALYSIS OF AN ALL SOLID STATE LINEAR TRANSFORMER DRIVER (LTD)

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The performance of an all solid state linear transformer driver (LTD) is evaluated based on experimentally verified behavior of a single stage. While the majority of high voltage pulse generators for HPM generation and industrial food processing applications rely on high voltage spark gap switches¹, an all solid state LTD is presented as a possible alternative for this pulsed power regime.

The single-stage LTD utilizes a low-profile design² with robust thyristor switches and high energy density mica capacitors to minimize overall system inductance. Sub-nanosecond jitter is achieved with simultaneous thyristor triggering. The stage is magnetically coupled to a secondary winding through a central Nanocrystalline core. A DC current source, decoupled with a large inductance, actively resets the core during pulsed operation. The overall result is a low-impedance (<1 Ω per stage) pulse generator that rivals the performance of traditional Marx systems with the improved reliability, increased lifetime, and fast rep-rate capabilities of solid-state switches.

The single-stage LTD is constructed in a cylindrical arrangement with a radius of 60 cm and height of 2.54 cm. The stage is tested with charging voltages up to 8 kV into various loads and compared with simulations based on an analog behavioral thyristor switch model previously developed³ at Texas Tech University. The simulation is expanded into a full-scale, 40-stage LTD simulation and analyzed for viability in driving HPM sources, such as a vircator.

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