

Design and construction of a vacuum tube guitar amplifier

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Abstract

This project focused on the design, simulation, and physical construction of a fully functional vacuum tube guitar amplifier. Modeled in LTSpice and built by hand, the amplifier features a high-voltage power supply based on the Hammond 270FX transformer, a dual-triode 12AX7 preamp, a phase inverter, and a push-pull 6L6-based power stage. Both diode-based and subcircuit models of the 5U4GB rectifier tube were implemented to evaluate performance trade-offs. A center-tapped RC-filtered power rail supplies each stage with progressive ripple reduction, and transformer windings were tuned in simulation to replicate the real transformer's behavior. In addition to simulation and testing, the final amplifier was physically assembled and housed in a hand-crafted wooden chassis. Voltage measurements, output signal behavior, and tonal character were analyzed throughout the signal chain. This project deepened our understanding of analog electronics, amplifier design, and high-voltage safety while blending engineering with musical creativity.

Index Terms

vacuum tube, amplifier, push-pull, rectifier, preamplifier, power amplifier, guitar amplifier, LTSpice, 5U4GB, 12AX7, 6L6, Hammond 270FX, analog design, tube audio, power supply, chassis fabrication