



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

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Thesis Title: **DESIGN AND IMPLEMENTATION OF NEW EXTENDED-BOOST QUASI Z-SOURCE INVERTERS FOR HIGH-BOOST DC-AC POWER CONVERSION**

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SHORT ABSTRACT

Power electronics has witnessed significant advancement in recent years, increasing the demand for compact, efficient, and flexible inverter systems capable of operating over wide voltage ranges. Traditional voltage-source and current-source inverters suffer from inherent limitations such as the inability to provide a voltage boost and vulnerability to shoot-through faults. Impedance Source Inverters (ISIs), particularly the Z-Source Inverter (ZSI), emerged as a practical solution by enabling single-stage buck–boost operation. However, the conventional ZSI produces a discontinuous input current due to its input diode, making it unsuitable for renewable energy sources such as photovoltaic (PV) systems and fuel cells.

To overcome these limitations, this thesis proposes three novel inverter topologies: the Diode-Assisted Switched-Inductor Extended-Boost qZSI (DA-SLEBqZSI), the Capacitor-Assisted Switched-Inductor Extended-Boost qZSI (CA-SLEBqZSI), and the Improved Extended-Boost qZSI (Improved-EBqZSI). These configurations achieve significantly higher voltage gain at reduced shoot-through duty ratios, thereby improving modulation capability and reducing device stress. Detailed mathematical modeling, steady-state analysis, and small-ripple design approaches are presented. The proposed topologies are validated through PSCAD simulations and laboratory prototypes. Results demonstrate superior voltage boosting capability and improved performance compared to conventional and enhanced qZSI structures, making them suitable for renewable energy and high-gain power-electronic applications.