Vishal Kumar Meena

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Education

University of Texas at Austin Aug 2022 - Present
PhD in Electrical and Computer Engineering

Indian Institute of Technology Delhi July. 2014 - May 2018
B.Tech in Electrical Engineering, Specialization in Embedded systems and VLSI

Work Experience

Graduate Research Assistant Dr. Alex Huang's SPEC group, UT Austin (2022-present)

- **Microinverters** — Designed a 1.6 kW GaN-based resonant PV micro-inverter (Buck–Boost + 1MHz LLC unfolder) achieving $\eta_{peak} = 99\%$ & 98% and 2× higher power density than commercial benchmarks (Team of two).
- Developed a 1.6 kW, 0.5 MHz GaN/SiC bidirectional LLC DCX (80–480 V) with optimized 3D planar-Litz flexible PCB windings to reduce copper and fringing losses, achieving $\eta_{\mathrm{FL}} = 97.1\%$ (validated by FEA and hardware).
- Developed a 4-port transformerless micro-inverter using a cascaded FSBB architecture optimized for high-FOM GaN; achieved 4× density, 98.1% efficiency; hardware-validated independent MPPT and PR grid current control.
- Extended **source-mismatch range** via **segmented-sine modulation and step injection**, reducing clipping.
- Developed a **source-loss-tolerant dual-input TLBB microinverter** for **PV–battery–grid integration**.
- **SST** —Developing a **GaN-assisted sub-ns adaptive gate driver** for a **10-kV SiC module**, controlling di/dt & dv/dt to reduce switching loss and voltage overshoot, in collaboration with **National Lab of the Rockies**.
- Leading development of **HVDC-side series-stacked SiC switching and control** using **3.3-kV and 10-kV devices** for a **$4M ARPA-E 30-kV/1-MW DC–DC SST**, enabling scalable **HVDC/UHVDC conversion**.
- **AI/ML** —Developing **simulation-trained, hardware-refined digital twins** with **physics-informed reinforcement learning** for autonomous interleaving optimization of decentralized heterogeneous converters.
- Developing **single-sensor predictive MPPT** for **cascaded μ-inverters** with fast tracking and diagnostics.
- TA: Designed a semester-long PMIC project on a V^2 peak-controlled buck converter with PWM/PFM hopping, OCP, MOS segmentation, and forced-DCM; mentored students through full Cadence implementation.

Scientist/Engineer - SD Indian Space Research Organisation (2018-22)

- Responsible for **design**, **realization**, ***qualification*** of Discharge Power Supply for *All Electric Propulsion System*
- Successfully ignited the 300mN Stationary Plasma Thruster **for the first time in India** (Team of 3 members.)
- Achieved **world-class efficiency** for Discharge Supply by employing PSFB **ZVZCS** topology *(engineering model).* (*η achieved = 93% (peak-96%), NASA's Lunar Gateway PPU = 95%*)
- Invented a **novel voltage-scalable ZVZCS topology** and designed a modular discharge supply for **high-Isp**, wide-throttle-range 200 kW-class nested-channel Hall thrusters targeting future Mars cargo missions.
- Analyzed **harness/filter effects** on **breathing-mode oscillations** to address **thruster quenching**.

Patent & Publications

- **V. K. Meena** et al., "High-Density Cascaded FSBB GaN Micro-Inverter," IEEE TPEC, 2026.
- **V. K. Meena** and A. Q. Huang, "Split-Sine Modulated GaN Micro-Inverter," IEEE PVSC, 2026.
- M. Heydari, **V. K. Meena** et al., "1.6 kW GaN PV Microinverter with Two MPPT Ports," IEEE ECCE, 2023.
- Invented and patented a **voltage-scalable ZVZCS converter (Patent No. 440340)** and built modular discharge hardware for **next-generation 200-kW Hall-thruster propulsion** for **Mars cargo missions**.

Projects

- Proposed and analyzed **hybrid liquid metal–water cooling** for Ga_2O_3 **devices** operating at **100–400 °C**.
- **Deep Learning:** Fine-tuned **Inception V3** for image captioning; implemented **CNNs** and **LSTMs**
- **CMOS ToF Image Sensor for LiDAR – B.Tech Thesis:** Designed a **successive-approximation TDC architecture and layout** with a novel, PVT-insensitive sub-clock delay cell using **path swapping** and **DLL**.

Skills & Interests

Technical: PLECS, MATLAB, SPICE, Cadence Virtuoso, Altium, Inventor, **ANSYS Maxwell/Icepak/Q3D**, Vivado/Libero, CCS | Python, C/C++, VHDL/Verilog | FPGA, DSP | **PyTorch, TensorFlow/Keras, Git**
Interests: Toastmasters, Football, UTA Archery Club, Motorbike enthusiast, Bibliophile