Salek Khan

Engineering Portfolio: salekakhan.com · LinkedIn: linkedin.com/in/salekkhan

Education - University of Texas at Dallas (Richardson, TX)

Doctor of Philosophy in Electrical Engineering - GPA: 4.00, Electromechanical Systems — Oct. 2025
Master of Science in Electrical Engineering - GPA: 3.93 — May 2025
Bachelor of Science in Electrical Engineering – GPA: 3.48 - Minor in Nanoscience and Nanotechnology — May 2021
Fellowships: Excellence in Education Foundation Fellowship (2023–2024), Jonsson School IAB Fellowship (2022–2023)

Experience

FEA Electromagnetic Simulation Engineer at 1X (San Francisco, CA May 2026 – Present)

- Own electromagnetic design and FEA for an eight-frame family of actuator motors (~20–130 mm) driving the joints of a humanoid robot, from topology trade studies through prototype validation
- Size machines to joint requirements by trading torque density, torque ripple, efficiency, thermal limits, rotor inertia, and mass, comparing topologies on volume-normalized motor constant ($K_m = K_t/\sqrt{R}$)
- Optimized tooth, back-iron, and magnet geometry of high pole count FSCW machines for motor constant and specific motor constant, isolating copper loss from total loss in JMAG to guide the tradeoffs
- Built parametric Python automation for JMAG-Designer that generates complete machine geometry, including triplet Halbach magnet arrays and high pole count FSCW stators, cutting design iteration from days to hours
- Led family-wide studies of magnet corner geometry, rotor lightening features, and cobalt-iron laminations, setting manufacturable limits that hold torque loss below 0.5% and framing cost and supply tradeoffs for sourcing
- Evaluated magnet retention sleeves and alternative architectures (magnetically geared, electrostatic) for a ~130 mm joint, coupling JMAG electromagnetic and loss analysis with Ansys Mechanical to set speed and stress limits
- Authored a 17-company actuator technology review that informs the team roadmap; support actuator group hiring

Senior Electromechanical Engineer at Bots Unlimited (San Antonio, TX Sept. 2025 – April 2026)

- Designed drone BLDC motors in several sizes, optimizing efficiency and torque density in Motor-CAD and Maxwell
- Reverse engineered leading BLDC motors to benchmark design, material, and manufacturing choices against ours
- Tested prototype units, root caused deviations from simulation, and fed corrections back into the models
- Created production CAD and drawings in SolidWorks with GD&T and tolerance stack-ups for manufacturability
- Qualified and sourced silicon steels, magnets, and wire with suppliers, weighing cost, lead time, and performance
- Supported bring-up and debug of a custom motor drive (ESC) with the power electronics team

Powertrain Engineer at Whisper Aero (Nashville, TN May 2024 – Dec. 2024)

- Led powertrain design for an eVTOL delivery drone, owning motor architecture from requirements through test
- Built detailed FEA models of inner and outer rotor PM machines, automated model creation in Python, and optimized designs with machine learning and genetic algorithms
- Ran dynamometer tests and motor teardowns; built a magnetic field uniformity rig to characterize incoming magnets
- Built a linear motor demonstrator; researched and improved motor manufacturing techniques

Research – University of Texas at Dallas

Research Assistant in Electric Powertrains Lab (EPL) under Dr. Matthew Gardner (Aug. 2021 – Oct. 2025)

- Designed, built, and dynamometer tested novel magnetic gears and electric machines, creating new topologies and winding arrangements on projects for NASA, Regal Rexnord, NSF, and US Army Labs
- Mechanically designed inner and outer rotor assemblies (rotor structures, bearing supports, magnet retention, tolerance stack-ups) in Onshape and SolidWorks, with parts 3D printed or machined
- Ran 2D and 3D magnetostatic and transient design studies in MATLAB and ANSYS Maxwell, Workbench, and Motor-CAD to optimize torque, torque ripple, losses, and mass and to check structural and thermal limits
- Built a topology optimization pipeline for magnetic gears: MATLAB-automated FEA, a CNN surrogate predicting torque and torque ripple, a genetic algorithm, and a breadth-first-search manufacturability check
- Work resulted in 9 IEEE papers (4 journal, 5 conference) and a pending patent

Raytheon Drone Hardware Design Lead (Aug. 2020 – May 2021)

- Led hardware for an autonomous drone that runs an obstacle course using image recognition on an NVIDIA Jetson: parametric 3D-printed frame, flight controller programming, sensors, and electric powertrain
- Won 2nd place overall at the Raytheon-sponsored UAS Showcase (2021) and 3rd place at the 2020 UTDesign Expo

Skills

Motor design: PMSM/BLDC machines (inner and outer rotor), FSCW windings, Halbach arrays, magnetic gears, cobalt-iron and silicon steel laminations, loss and thermal analysis, GD&T and tolerance stack-up
Software: JMAG-Designer (Python scripting API), ANSYS Maxwell, Motor-CAD, Mechanical, and Workbench, MATLAB/Simulink (motor drive models with SVPWM and DTC), Python, C, SolidWorks, Onshape, Fusion 360, PLECS, PSPICE, KiCad, Altium
Hardware: dynamometer test stands, power analyzer, oscilloscope, LCR meter, gaussmeter, motor drive/ESC bring-up, Hall effect and encoder sensors, Arduino/ESP32/MSP430 microcontrollers
Fabrication: FDM/SLA 3D printing, CNC mill and lathe, soldering (through hole/SMD)

Publications/Patents

- **S.A. Khan**, P. Afsari, and M.C. Gardner, "Analysis of Bridge Placement and Ferromagnetic Piece Curvature on Performance of Radial Flux and Flux Angle Mapping Magnetic Gears," *IEEE IEMDC*, 2025.
- **S.A. Khan** and M.C. Gardner, "Comparison between Flux Angle Mapping and Cycloidal Magnetic Gears for High Gear Ratio Applications," *IEEE ECCE*, 2024.
- P. Afsari, **S.A. Khan**, and M.C. Gardner, "Comparative Analysis of NdFeB and Ferrite Radial Flux Focusing Coaxial Magnetic Gears," *IEEE ECCE*, 2024.
- A. Daniar, **S.A. Khan**, and M.C. Gardner, "An Outer Rotor Surface PM Motor With Integrated Chokes for Fault-Tolerant Operation in the Presence of Short-Circuit Faults between Adjacent Turns," *IEEE Trans. Energy Convers.*, 2024.
- A. Daniar, **S.A. Khan**, and M.C. Gardner, "A Passive Inter Turn Short Circuit Fault Mitigation Technique for Electric Machines," *IEEE Trans. Energy Convers.*, 2023.
- **S.A. Khan**, G. Duan, and M.C. Gardner, "Comparison of Modulator Retention Shapes for Radial Flux Coaxial Magnetic Gears," *IEEE Trans. Energy Convers.*, 2022.
- **S.A. Khan** and M.C. Gardner, "Flux Angle Mapping Coaxial Magnetic Gears for High Gear Ratios," *IEEE ECCE*, 2022.
- **S.A. Khan** and M.C. Gardner, "Development and Analysis of a Homopolar Consequent Pole Transverse Flux Magnetic Gear," *IEEE IEMDC*, 2022.
- G. Duan, E. Sutton, M. Wang, M.C. Gardner, **S.A. Khan**, and B. Praslicka, "Cycloidal Magnetic Gear Combining Axial and Radial Topologies," *IEEE Trans. Energy Convers.*, 2021.
- **Patent US20240297563A1** (pending): "Magnetic gear systems, methods, and apparatuses"