info

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Rice University Electrical and Computer Engineering BSEE

summary

Hardware and Power Electronics electrical engineer passionate about finding clever, right-sized solutions to otherwise intractable problems through application of deep understanding of intended application and underlying technologies

projects

- New Shepard Crew Capsule Escape Controller
  - Integration of 2 Industrial Brushless motor controllers powered by in-house designed Ultra-capacitor bank. ~200V DC Link, 16kW peak. Ultracap bank active balancing, measuring circuits, soft-start/pre-charge, constant current flyback converter for charging from low voltage
  - Design, build, and integration of a test stand for motor including working with mechanical teams to integrate custom mechanical test fixtures. Bringup and integration of COTS hysteresis dynamometer + power analyzer + power supplies + oscilloscopes for understanding worst-case loading margin
  - Human Safety Critical Design integration
- BE7 Lunar Landing Engine ECU
  - Architecture, design (schematic), interfacing with internal layout engineers, bring-up, deep integration with controls engineering and FPGA verilog for design of a 3rd-harmonic-injected field oriented control PMSM inverter. Radiation hardened by design. 120V, 1.2kW inverter design.
  - Simulation, worst-case analysis, FMECA, top-level requirement to low-level requirement translation and mapping
- BE3U Upper Stage Engine Technical Lead
  - Architecture and guidance of team of 4 Electrical Engineers + 2 Mechanical Engineers to design an Engine Control Unit for upper-stage Liquid Hydrogen + Liquid Oxygen rocket engine with several layers of redundancy for sensing Pressure Transducers, Thermocouples, Variable Reluctance Speed Sensors, actuation of solenoid valves and position control via electro-hydraulic servo valves
  - EMI Testing - MIL-STD-461G suite of tests including: Lighting strike, conducted and radiated emissions, conducted and radiated susceptibility at audio and radio frequencies
  - Ethernet 100-BaseTX signal integrity simulation including anchoring with VNA and custom test fixtures, basic de-embedding, matching to IEEE 802.3 specs, custom limits for our application, compliance testing
- Multi-Engine Common ECU
  - Architecture, design, bring-up, deep integration between controls and FPGA for a 7kW, 240V, SiC FET inverter intended to be used with a wide variety of motors
  - Double-Pulse Testing, Parallel MOSFETs, active-standby switch-over, multi-wound motors
  - Multiple customers, multiple voltage, multiple motor and end-effector targets
  - Long-Term space environment and atmospheric exit and reentry makes for a wide environmental range
- In House Resolver to Digital implementation
  - Led architecture, design, implementation of an in-house designed, radiation tolerant Resolver to Digital conversion stack
  - Dramatic reduction in price, easier to source components, large flexibility in trade-off between speed and resolution
  - Oversaw integration of delta-sigma modulator, digital filters, trade-offs for position control at high velocity
  - Made use of multiple new-grad rotation engineers that required design to be broken up into short chunks
- Training and Bring-up of other engineers
  - Find great enjoyment in coaching, teaching, and direct in-lab guidance of other engineers
  - Held various classes for other engineers on technical topics: advanced SPICE usage, IBIS Model usage, Signal Integrity design + simulation + verification, motor control design
- Hardware-in-the-Loop (HIL) and Automated Electronics Tester
  - Architecture, design, layout, testing, build-out of a full vehicle Hardware-in-the-Loop facility for a sub-orbital rocket and crew capsule
  - Clever in-house designs for simulation of sensors including: LVDT, VR, PT, Silicon Diode, TC, Solenoid Valves, Brushless motors, pyrotechnic initiators, electro-hydraulic servo valves, battery charge/discharge, INS/GPS, crew microphones, Ethernet network
    * Exploited electrical simplicity of sensors to use 3 basic COTS Analog/Digital I/O system to simulate each sensor at full dynamic resolution ideal for our requirements of each sensor type
    * Dramatic reduction in cost and complexity from a commercial HIL or sensor simulation system

* Used same exact hardware for acceptance testing during Vibe, Shock, Thermal, Vacuum testing

patents

- US11936317B2 - Low-voltage fault-tolerant rotating electromechanical actuators, and associated systems and methods

interests

- Hobby hand-tool woodworking
- Hobby machining and fabrication/welding
- Volunteering for Seattle Community Networks doing internet installs for under-privileged areas of Seattle