Andy Makovec

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SUMMARY

Hardware test engineer with cross-functional experience in designing and implementing tests for hardware design validation and reliability. Seeking challenging and impactful hardware test, systems validation, HIL, manufacturing EOL, and integration engineering positions in the Bay Area (on-site).

EDUCATION

The Ohio State University, Columbus, OH (May 2019)
Bachelor of Science, Electrical and Computer Engineering - GPA: 3.70/4.0

ENGINEERING EXPERIENCE

Tesla, Palo Alto, CA
Senior Electrical Test Engineer (Jan 2022 - Present)
Member of the Low Voltage Test Team, focusing on controllers for brakes, steering, and body controls.

- Braking controls PCBA validation and reliability testing
  - Led in-house reliability testing. Collaborated with design teams to develop a reliability test plan. Developed Python software for reliability tests and functional checks.
  - Led power consumption testing. Wrote embedded C firmware (application on top of existing RTOS) to actuate brake calipers. Wrote an arbitrary waveform generator in C to generate braking profiles, reducing flash memory requirement and avoiding jitter over CAN.
  - Wrote Python scripts to send commands to firmware, control and capture power and temperature data from NI DAQs, control and capture data from oscilloscopes, and monitor for over-temperature events.
  - Designed and implemented a web dashboard (streamlit, plotly) to intuitively display collected results to a variety of stakeholder teams
- Steering controls PCBA validation and reliability testing
  - Led in-house reliability testing for steering control PCBAs
  - Wrote Python software to apply a motor speed and torque profile while monitoring for faults, including monitoring and interlock hardware/software for test setup safety.
  - Root-caused a steering PCBA failure identified on multiple vehicles during proving ground testing. Designed a test that reliably reproduced the issue via HTHE. Identified the failure mode via DUT instrumentation with oscilloscope and Python script to monitor scope trigger and power supply currents. Worked with design team to implement a rework/retrofit for existing boards and a design change for production builds.
  - Performed thermal characterization testing of FETs, diodes, and microcontrollers used in the assembly
- Body controls validation and reliability testing
  - Contributed to hardware validation of several body controllers in zonal architectures for multiple vehicle platforms, which included both heavily integrated and discrete circuits for both convenience and safety features. Circuits include HSDs, eFuses, 3-phase brushless motor drivers, H-bridge brushed motor drivers, amplifier circuits, safety interlocks, and others.
- Internal test equipment hardware platform
  - Revised an internal backplane power and communications board for use in a bespoke rack mount (42U) testing solution. Major redesign to replace end-of-life components, complete tear-up+reroute to fix signal integrity issues, fixed Ethernet termination scheme
  - Designed a board to interface a major new vehicle BCM with internal test equipment. Designed a schematic with circuits to test all drivers and communication lines on the BCM. Performed layout (50+ connectors w/ 500+ pins).
  - Designed a power supply adapter PCBA for low-cost supplies (analog in/out -> Ethernet + USB), saving $530k in lab equipment costs
- Internal test equipment firmware
  - Resolved several networking firmware issues that were leading to random, infrequent, and difficult to reproduce disconnects (lwIP memory configuration)
  - Ported a bootloader w/ network update capability to an STM32 microcontroller, and ported its build system from a bespoke Python build script to CMake.
  - Implemented a pulse width measurement feature on an existing test instrument PCBA via STM32's input capture feature and IRQ handlers / callbacks
  - Porting Mbed OS to previously unsupported STM32 microcontrollers, including errata implementation

- Internal test software platform
  - Wrote validation tests for discrete, bespoke circuits for eFuse and safety interlock circuits on vehicle BCMs
  - Ported validation test software to several new revisions of vehicle BCMs
  - Migrated lab from Windows to Linux. Deployed and managed Ansible server + playbook w/ nightly automation to ensure fleet of Linux lab computers (50+ nodes) are up to date and retain identical configuration.
  - Consolidated body controller reliability testing software, reducing copy-pasted function usage. Led teammates in the consolidation, helping with git branching/merging.
- Mentored 10+ interns and junior engineers by directing design and review for BCM validation and reliability testing projects, and PCB design projects
  - Body controller reliability and validation testing.
  - 6-channel High-side NMOS switch + current sense for transient load testing.
  - 12-channel speaker load emulation + 96kbps streaming audio capture board
- Onboarded office in Shanghai, China on using internal hardware and software for BCM validation and reliability testing.
- Worked with multiple contract manufacturers to spec, design, quote, and fabricate test equipment
- Collaborated with technician team to set up test hardware, debug tests, perform data collection, and update tickets

Rockwell Automation, Mayfield Heights, OH
Hardware Test Engineer (May 2019 - Dec 2021)

- Designed development boards to enable test automation in prototype and final test stages for NPI I/O products:
  - Designed for requirements such as multiple isolation zones, 12+ high-speed gigabit signals (Ethernet RGMII), and several power integrity requirements, resulting in designs of 200+ components per board.
  - Led and performed circuit design, schematic entry, constraints definition and entry, and component selection.
  - Oversaw layout performed by a separate layout designer. Facilitated resolution of placement conflicts.
  - Designed a quick-turn PCB to test a high-risk subcircuit (totem pole gate driver w/ 10ns low->high drive time). Created and executed test cases to verify the subcircuit.
  - Led DMI review and PCB DFM processes, and assisted in material ordering and organizing production runs.
  - Created test cases for board bring-up and design verification test, and assisted in execution of tests.
- Designed and implemented Python scripts for test automation and results analysis:
  - Designed a Python script to capture test results from multiple pieces of test equipment and generate a test report containing 3000+ data points. Included a user-friendly GUI for use by technicians.
  - Designed a Python script to visualize backplane communication failures with a heatmap.
- EMC test plan generation (IEC 61000), specifically with regards to ensuring hardware was exercised to functional requirements while under exposure to noise:
  - Wrote functional requirements for and implemented Ladder Logic programs (Allen-Bradley) for test automation.
  - Coordinated requirements with firmware teams to prioritize features required for testing. Led flashing of firmware and installation of software to 8 early prototype test setups in order to enable preliminary EMC testing.

TECHNICAL SKILLS

- **Hardware Design:** High speed (Ethernet 1000BASE-T, 100BASE-TX, and 1000BASE-T1), brushed and brushless/3-phase DC motor drivers, high-side FET drivers / eFuses, op-amp / in-amp based amplifiers, microcontrollers (pinout assignment, layout, and firmware), grounding analysis, power supply design (buck, boost, buck-boost, single and multiphase)
- **Embedded Firmware (C):** Communication (Ethernet, USB, SPI, I2C, UART, CAN), standard peripherals (ADCs, DACs, GPIO), interrupts (timers, inputs, input capture), RTOS (Mbed OS), STM32 HAL and LL, CMake
- **Design Capture:** Altium Designer proficiency (schematic, layout, rules, constraint manager, DRC, part management, Draftsman, and Altium 365), Mentor Graphics proficiency (Xpedition design capture flow, HyperLynx SI/PI modeling, library management), KiCAD competency (design capture and library management), HFSS (EMag FEM) and FEKO (antenna design) familiarity.
- **Programming Languages:** Python proficiency, Embedded C competency.
- **Version Control:** Git, GitHub, GitLab, and SVN competency.
- **Standards (familiarity, not certification):** IEC 61000-6-4, ISO 26262, IEEE 802.3
- **DAQ Systems:** LabJack, NI CompactDAQ (cDAQ) and PXI, Keysight/Agilent DAQ970A.
- **Other Skills:** LTSpice, CATIA V5/V6, 3DExperience, MATLAB/Octave, SAP ECC, Rockwell Software (Studio 5000, RSLinx, FactoryTalk), CMake, Ansible, Bash, Jira, GitHub Actions, Linux (Ubuntu/Debian, Arch)

PERSONAL

- Backpacking, biking, golfing (35 hcp, not great!), and fishing (esp. surf fishing & crabbing)