101_ and 102_FullRobot.jpg

Screen grabs of a fuming nitric acid environment 3 DOF manipulator that presents nothing but plastic parts and plastic coatings to the world. All cabling is internal. The volume is N2 pressurized. Used for moving PTFE fixtures of discrete semiconductor devices between acid and cleaning baths. Accuracy on the order of .015. Repeatability on the order of .005. Sole design engineer this project, hardware, motion control, and high level process accounting.

20171128130001384.jpg

A 17-DOF end-effector used to retrieve, buffer, handle, present, install, and verify automotive circuits. This was for a 100% automated wiring harness assembly system. Lead Mechanical Designer this project. System built at SwRI Robotics and Automation Division 5, San Antonio, TX around 1992.

20171128130011354.jpg

The three 2nd-generation SwRI Aircraft Paint Stripping Robots, fielded to Warner Robins ALC, Georgia, around 1990. These three machines depainted large fighter and small fighter-bomber aircraft for more than a decade before being superseded by the gen 3 systems. Each machine is 9 DOF, running on railroad tracks embedded in the floor. The equipment box at the bottom of each may be dismounted and disconnected and rolled to a maintenance facility separately for debug and repair. System repeatability approximately one-tenth inch at worst throughout the envelope. The equipment cabinet of the middle robot is shown with doors open and panels extended for demonstration. Lead Mechanical Designer this project.

20171128130032513.jpg

Automation Engineering cover reprint for SwRI automated wiring harness assembly system.

20171128130042484.jpg

The sequenced circuit storage array on its semiautonomous vehicle and docking indexer employed in the SwRI automated wiring harness assembly system.

20171128130335309.jpg

The last unclassified representation of a special purpose aerospace coatings application robot. Lead Mechanical Designer this project.

Capture1 and Capture4.jpg

Photos of the semiautomated wiring harness assembly system first built for EControls spinoff Automated Wiring Systems circa 2011. This system decreased automotive harness assembly time by an order of magnitude while cutting test failures to immeasurably low levels. The system consists of:

- Random Access circuit storage buffer, a wheeled box about 10' long, 4' high, and 3' wide. The array consists of almost 4000 tubes, each of which can store one circuit. The end of a buffer is visible behind the unloading tube conveyor.
- Unloading Tube Conveyor and Presentation Tray, the angled conveyor belt tube shown left of center between the operator and tool array, which captures ejected circuits from the buffer and moves them to the presentation tray at the bottom of the assembly board.
- Assembly Board, an intelligent backplane with modular connections and four processors per 4' long module.
- Intelligent Tools, connector blocks, each with a single board computer, connect the backplane to the connector pins. Each intelligent tool communicates with the backplane via a CANbus link and six conductors, and can support an arbitrary number of test pins. The tools also backlight target cavities.
- Displays, above and behind the board, prompt the operator with the next action.
- Component parts bins, behind the operator, employ access verification and visual prompts to direct the operator to the correct bin.
- Machine mode display, on the rack behind the operator, chooses assembly and test mode and allows the operator to load harness scripts.
- Welding gantry, the overhead yellow steel gantry with 80/20 rails supports a semi-automated ultrasonic welding head which can dock with specific splice locations.
- Not shown – The crimpcenter and buffer loader, an industry standard flexible, reprogrammable circuit builder plus a pneumatic device for conveying complete circuits into the storage buffer tubes, elsewhere on the floor. Each buffer loader fills three buffers at a time, a day and a half of ready circuits in one cell, which takes about two hours total.

Each assembled circuit can be tested for simple continuity, or for complex impedance, or for frequency response. System architect, assembly language developer, lead mechanical design, and high level programmer. A second engineer designed the modular backplane and the single board tool post computers, and developed the embedded microcontroller code for both. A third engineer developed the motion control systems for the buffer loader and for the unloading conveyor.

links.htm

A collection of hyperlinks to automotive, construction, and hobby projects.