

# Custom Robotics and Controls

A custom-built robotic gripper is shown in a laboratory setting. The gripper is a complex assembly of black metal plates, wires, and connectors, mounted on a white robotic arm. It is holding a glowing yellow wireframe object, possibly a small robot or a sensor. The background is a bright orange wall, and the foreground shows a metallic surface with some cables and components.

Southwest  
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San Antonio, Texas

## Southwest Research Institute

**F**ounded in 1947 as a nonprofit research and development organization, Southwest Research Institute provides significant research, engineering and testing resources for industry, business, and government. With 11 technical divisions and state-of-the-art laboratories, the Institute uses a multidisciplinary, integrated approach to solving complex problems in science and applied technology. Subject to the client's wishes, programs are kept confidential. As part of a long-held tradition, patent rights arising from sponsored research at the Institute are often assigned to the client. SwRI generally retains the rights to Institute-funded advancements.

**S**pecialized robotic solutions are often required to meet the needs of cutting-edge development. Southwest Research Institute (SwRI), with its diverse expertise and state-of-the-art facilities and equipment, integrates advanced and commercially available technologies into custom robotic systems to solve a variety of automation needs. To meet the needs of commercial and government clients, SwRI offers the following services:

- Custom control system development
- Forward and inverse custom kinematic solutions
- Robot modeling and simulation
- Cooperative robotics
- System fabrication, testing and installation
- On-site robot performance evaluation
- Applied robotic research
- End effector design and development
- Adaptive, force feedback and visual servoing
- Distributed control architectures
- Compliance
- Custom robotic system development, including design, simulation, kinematic and dynamic analyses, fabrication, testing and installation
- Fuzzy-logic control



*Developed specifically for research applications, this planar redundant link robot has been used to test control algorithms for kinematically redundant robots. SwRI engineers designed the apparatus to be modular so as to enable it to be quickly modified for special research applications.*



*Using a stereo-based laser end effector and computer vision techniques, this two-robot system locates, identifies, and removes flaws on the surface of aircraft cockpit canopies.*

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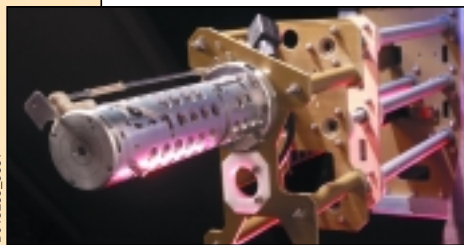
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*When the capabilities of commercially available robotics are inadequate for a specific function, SwRI engineers push the boundaries of mechanical, electrical, and controls design to create a custom solution.*



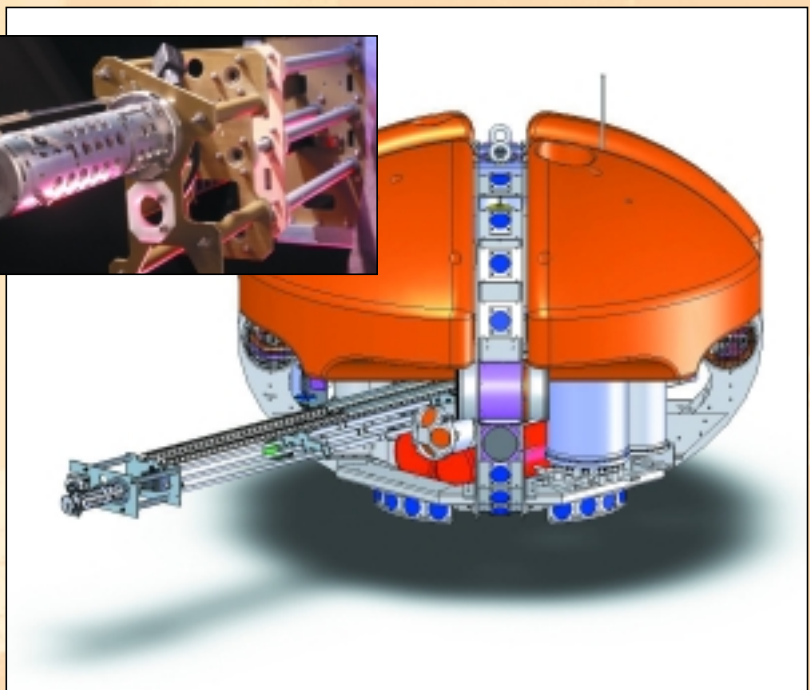
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*The robot shown here performs torque converter vane insertion using a fuzzy-logic-based force-feedback control algorithm. The force-feedback control approach allows the robot to adapt its motions in real-time in response to feedback from the assembly operation. This technology permits the use of robotics in applications unsuitable for traditional "fixed-path" control schemes, such as press-fit or high-variability assembly tasks.*



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*As part of an underwater exploratory vehicle, SwRI engineers are developing a suite of sampling devices including environmental and vision sensors, a water-sampling system using computer vision to identify unique microbial life, and a robotic arm (inset) to retrieve liquid and solid samples from the underwater environment. The autonomous robotic vehicle will serve as a pilot for possible future explorations of other planets.*

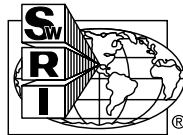


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*Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies more than 1,200 acres and provides nearly two million square feet of laboratories, test facilities, workshops, and offices for more than 3,000 employees who perform contract work for industry and government clients.*

*We welcome your inquiries.  
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