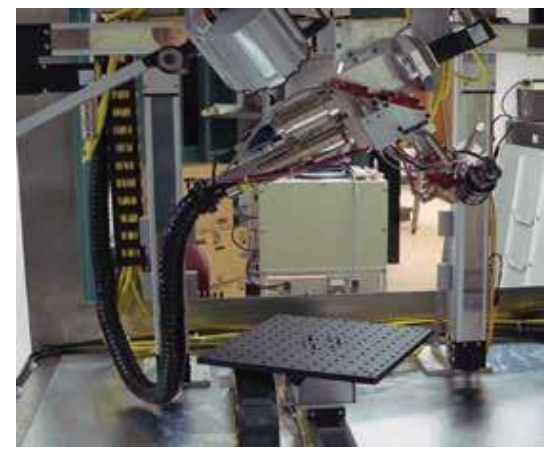
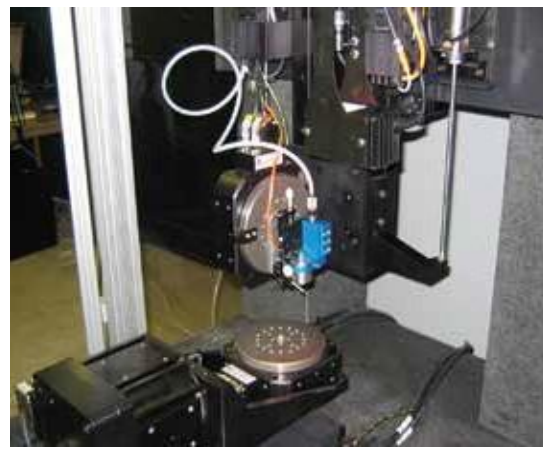
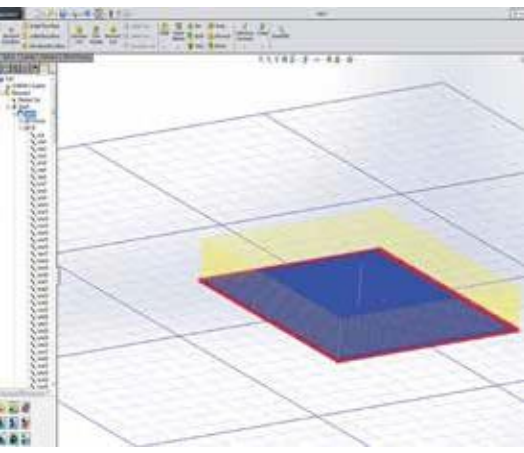
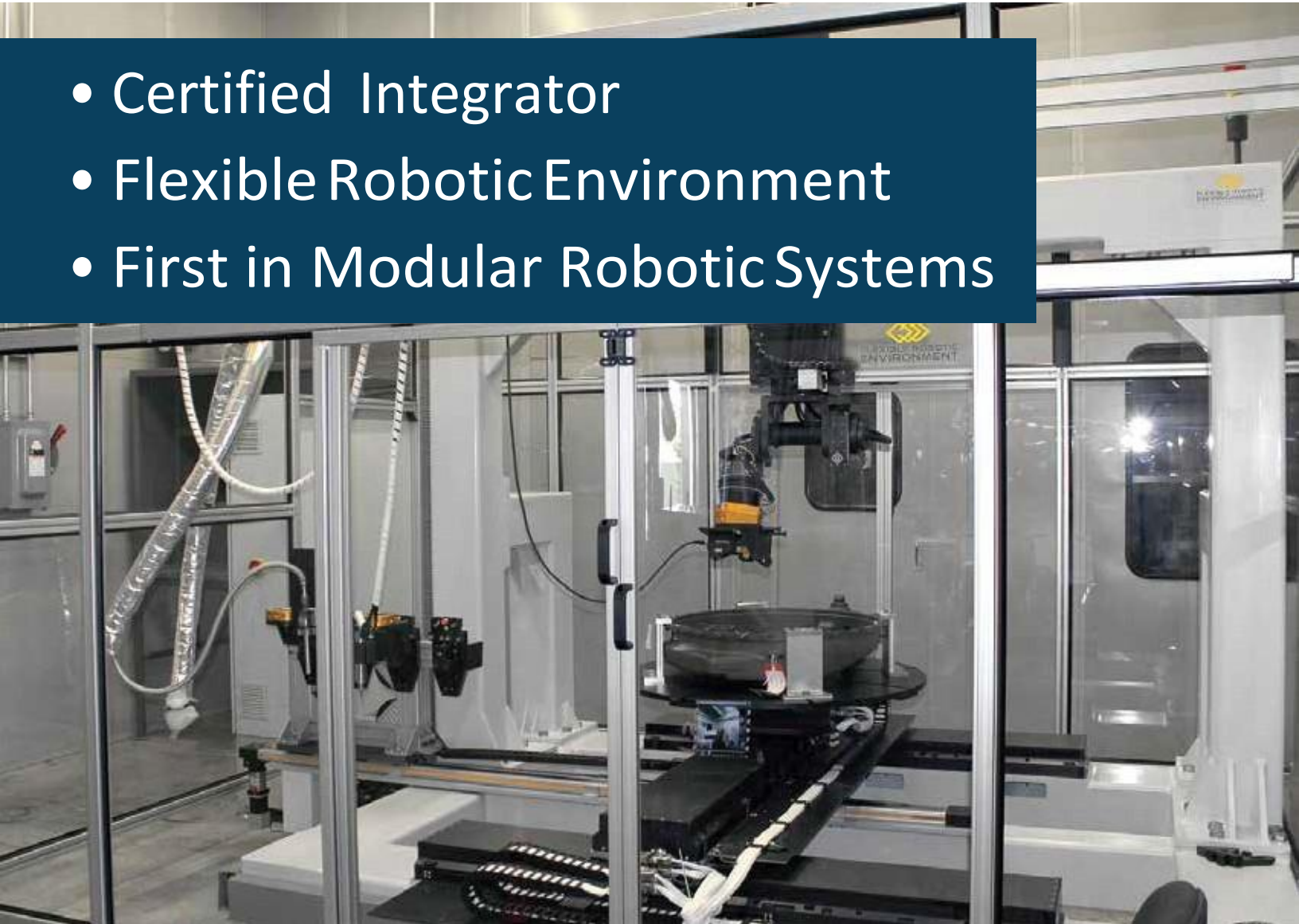


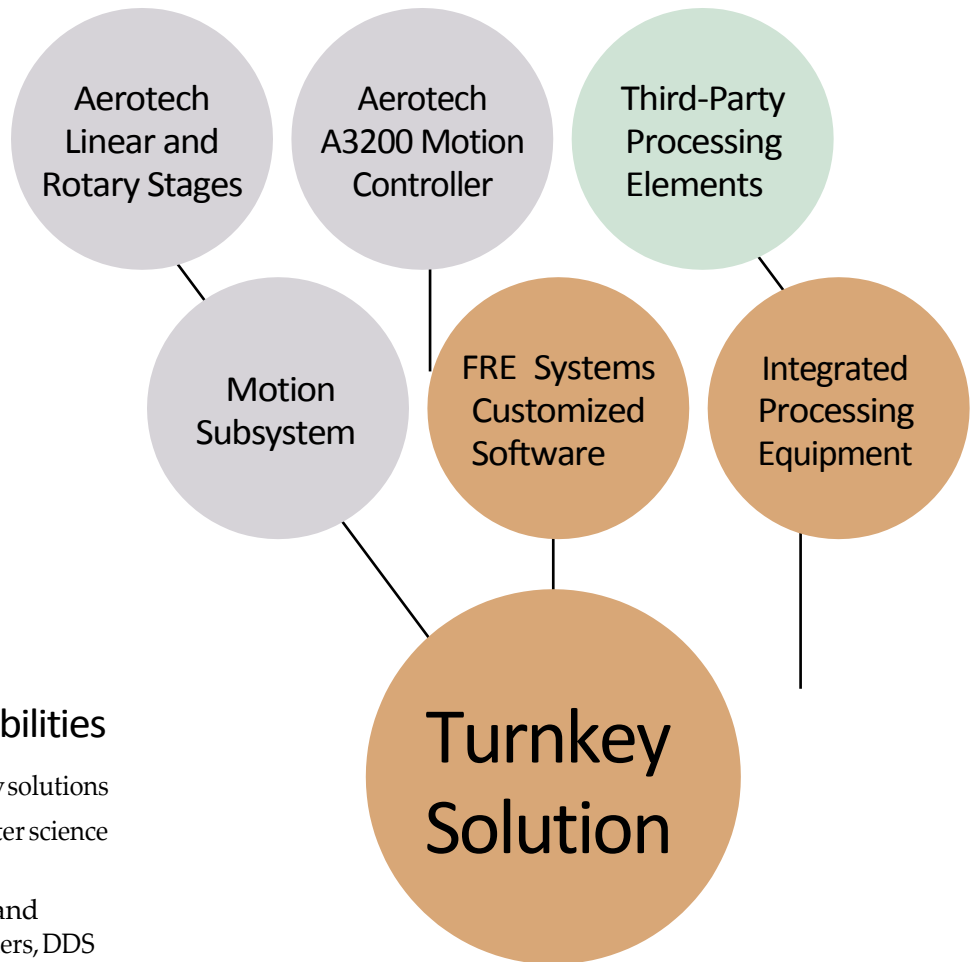
- Certified Integrator
- Flexible Robotic Environment
- First in Modular Robotic Systems



Customizable Controls + Integrated Mechanics = Fully Integrated Solutions

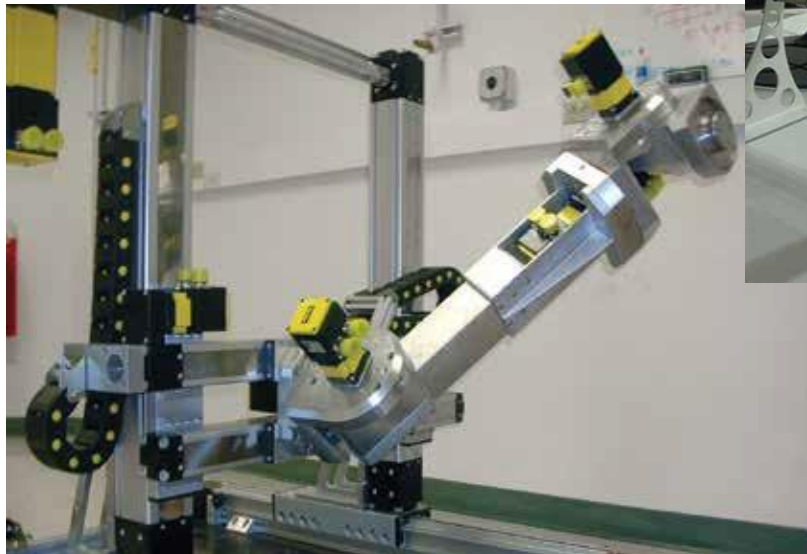
FRE Systems – Software Solutions and Integrated Systems

FRE Systems offers motion software and integrated motion systems solutions for a variety of applications, including customized software for 3D robotic environments and turnkey processing machines. FRE Systems utilizes the Aerotech product family of motion equipment and motion controllers combined with custom software and integration to develop a tailored solution for your application.



FRE Systems Build Capabilities

- Delivering fully integrated turnkey solutions
- Mechanical, electrical, and computer science engineering and design
- Electronic component design and manufacturing (industrial controllers, DDS card, encoder echoing card)
- Robotics and automated manufacturing
- Full-capacity control systems software development
- MMI custom development
- Control panel build
- System prototyping
- On-site start-up and support
- Training



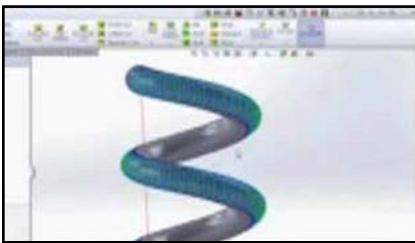
FRE Systems Proprietary Software

Inverse Kinematics Algorithm

FRE's inverse kinematics algorithm takes work points and 3D motion commands from a coordinate system in virtual space and converts them to system motion in the working environment.

- Supports standard and redundant manipulators
- Supports motion in all standard robotic coordinate frames
- Realized through the IEC 61131 standard to allow open architecture approach
- Easily structured software package that can be realized in five standardized languages
 - Instruction List
 - Structured Text
 - Functional Block Diagram
 - Ladder Diagram
 - Sequential Functional Chart

MoDus-CAM™ SOLIDWORKS® API – CAD-TO-MOTION Application



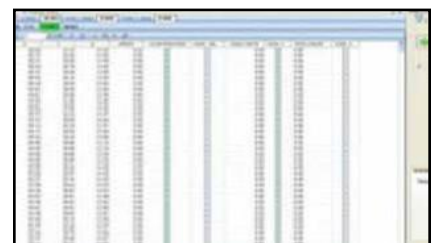
3D Part Created in SOLIDWORKS®

- Import customer 3D files
- Draw path directly on parts
- 3D interface
- Ease of use in SOLIDWORKS®



Path Creation Directly on Part Surfaces

- 3D path
- Surface modification – cladding
- Slicing – 3D printing
- Define parameters of the process
- Graphical representation

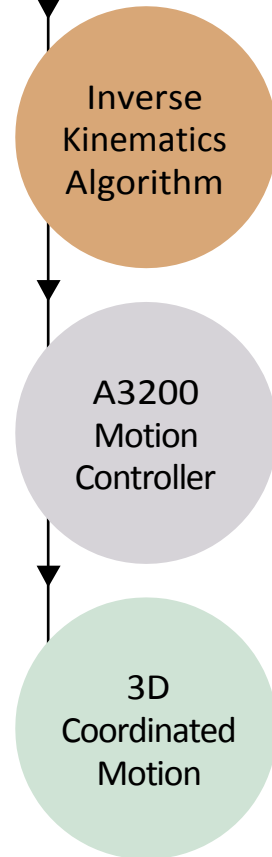


Export Path

- Import customer 3D files
- Draw path directly on parts
- 3D interface
- Ease of use in SOLIDWORKS®

User Inputs:

- CAD Drawings/3D Motion Commands
- Process Parameters

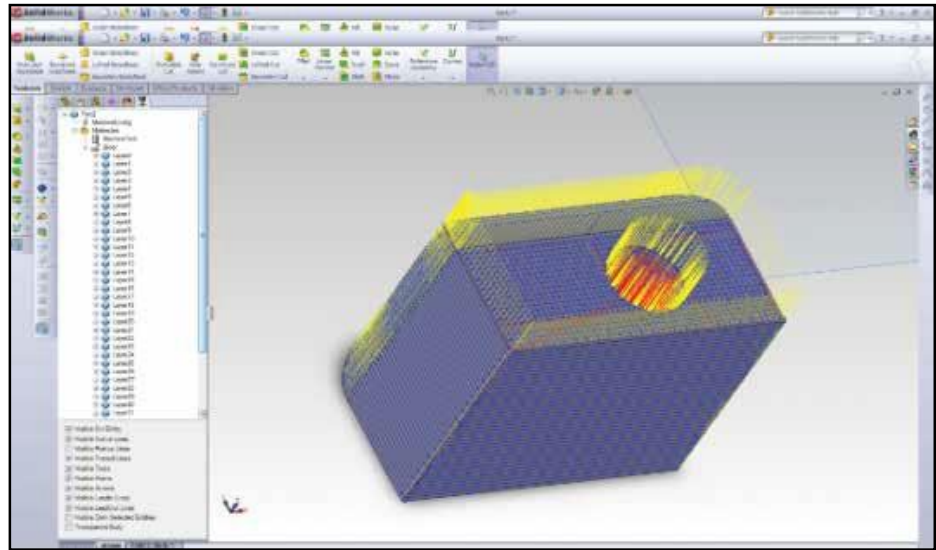


FRE Software Solutions

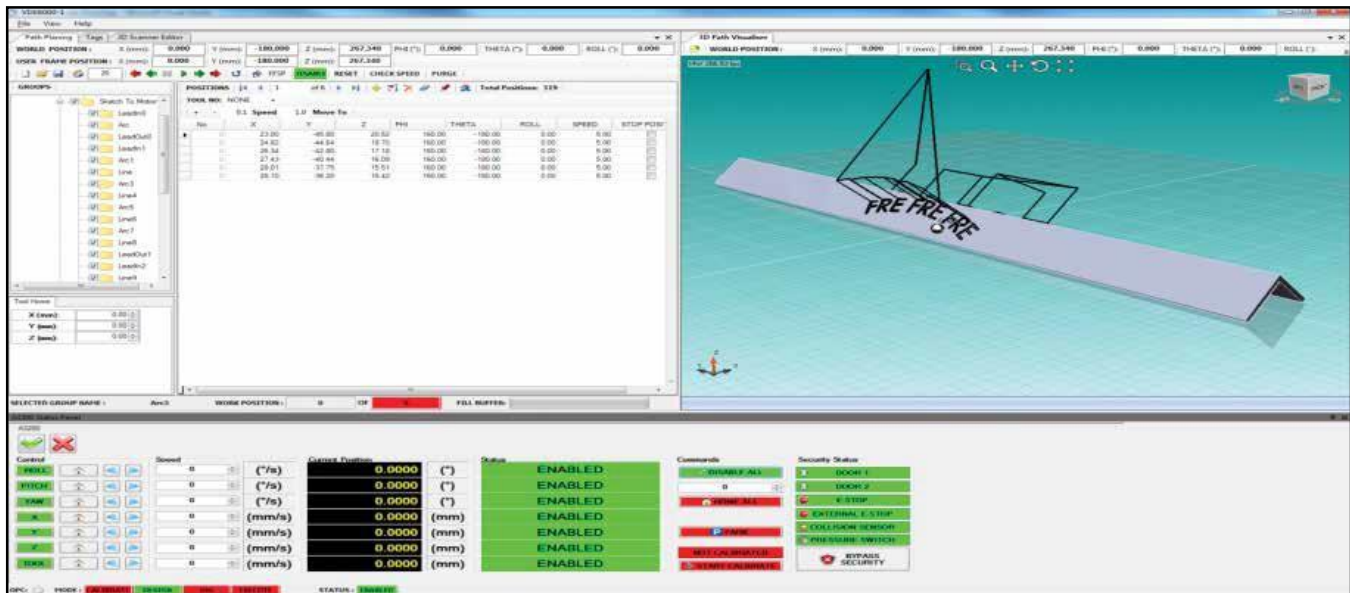
FRE Systems has extensive experience developing software for Aerotech motion control platforms and offers customized front-end software solutions designed for your specific application.

Examples of previously developed applications include:

- Proprietary software for additive and subtractive manufacturing applications and macros within SOLIDWORKS® gives the user the ability to:
 - Import a solid model of part
 - Select material to be processed additively or subtractively
 - Export motion trajectories for part processing

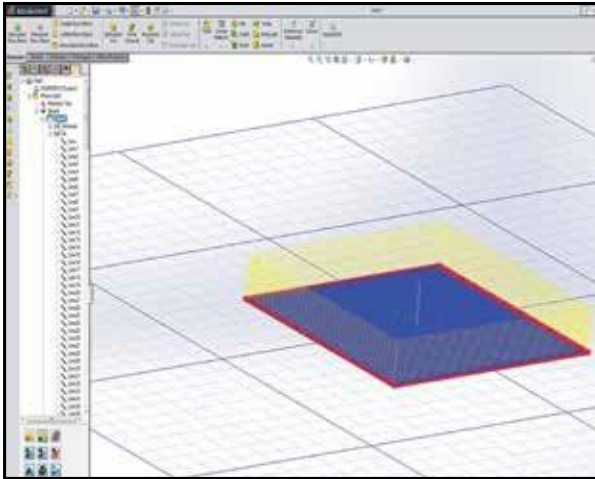


Surface processing with specific tool orientations and paths

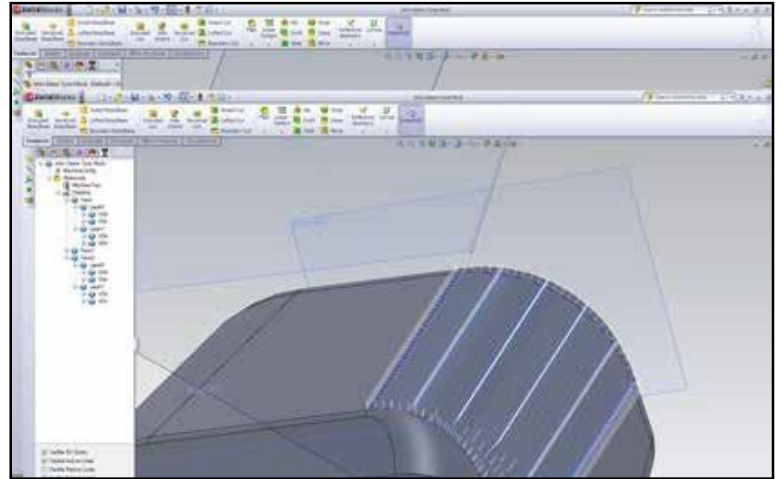


Direct-write path planning applications

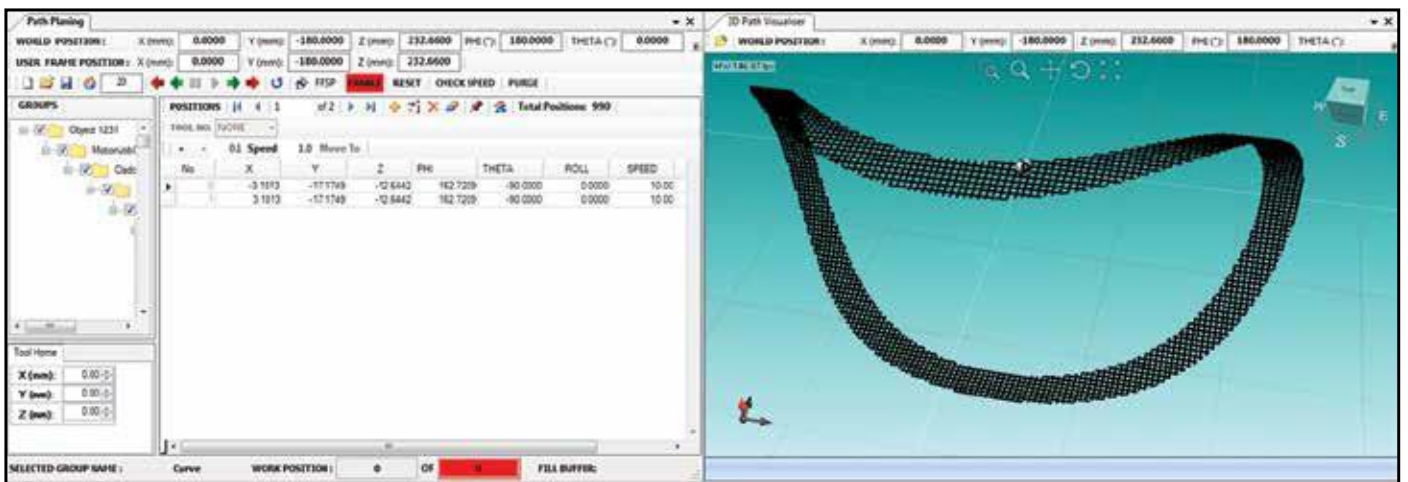
3D Surface Path Planning



Surface processing with specific tool orientations and paths

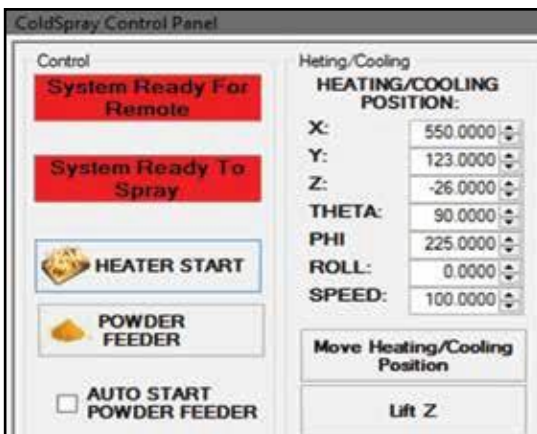


Specific tool orientations



Customized, application-specific human-machine interfaces

System Status Feedback Interfaces



Turnkey System Application Examples

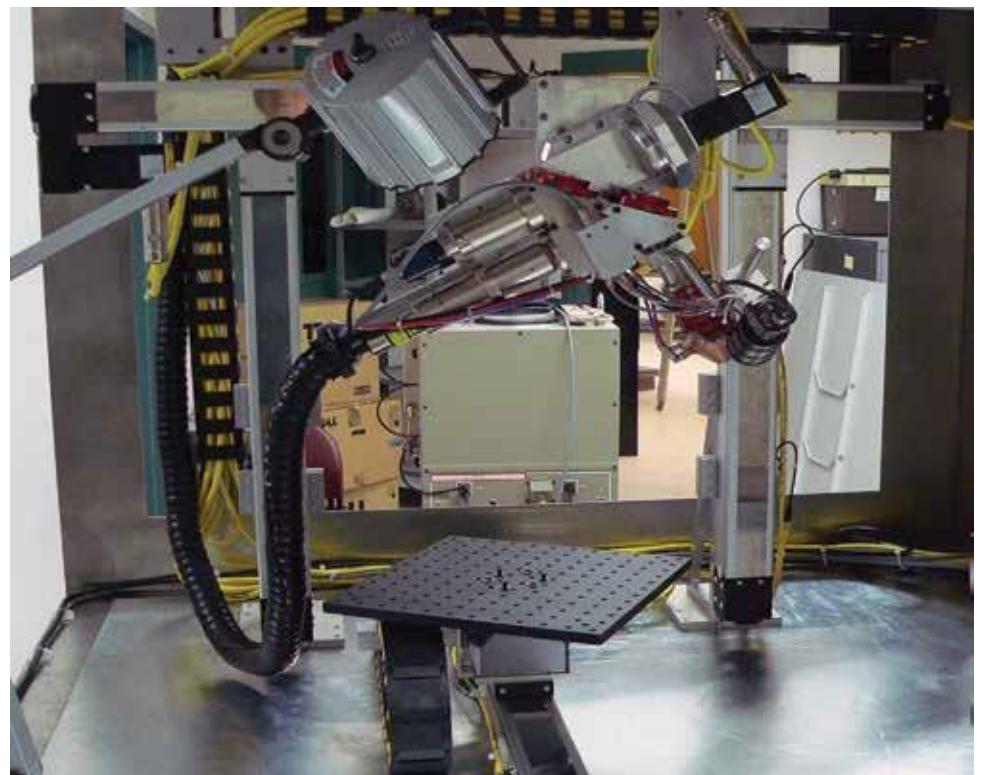
System VDK1000 6DOF Jewelry Processing System

- Flexible ring polishing robot that mimics all manual operator motions
- Works with all standard polishing wheels and rouges
- Open architecture system that allows a high level of customization
- Increases efficiency and consistency



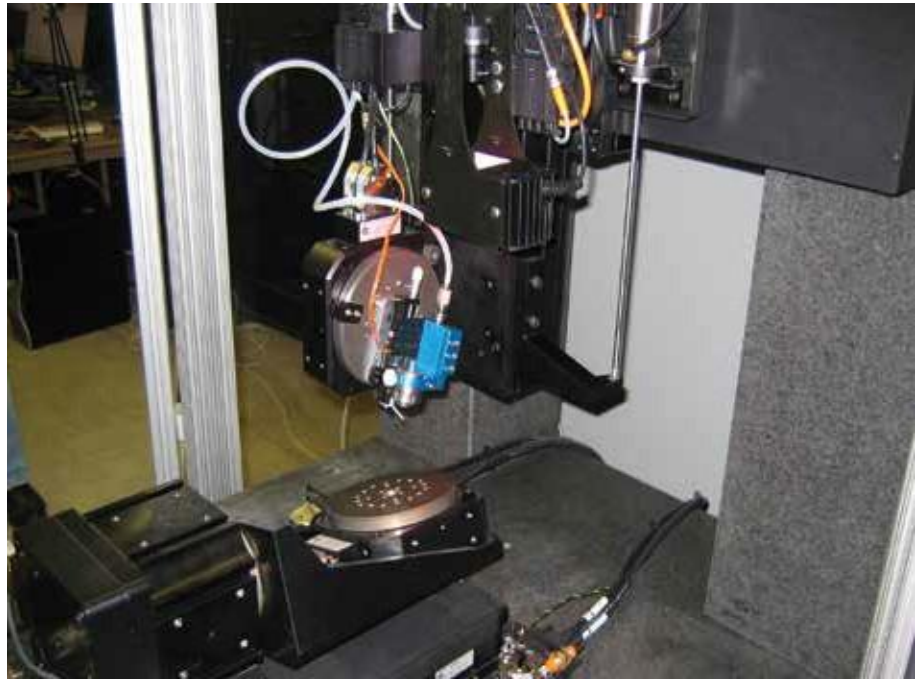
System VDK3000 6DOF Laser Deposition System

- Capable of depositing various materials in laser additive manufacturing processes
- Various applications including biomedical device repair, air-seal repair, glass dome scribing, and ceramic etching



System VDK4000 6 DOF Direct Write System

- Capable of printing on extremely complex 3D substrates
- Includes graphical CAD-to-motion path planning capabilities
- Greatly increases part finish times by eliminating defocusing and manual adjustment



System VDK6000 6DOF Robotic Cell for Metal 3D Printing and Metal Part Refurbishing

- Provides additive and subtractive manufacturing capabilities
- Laser scanning for creation of 3D CAD solid models in SOLIDWORKS®
- Ultrasonic inspection for verification of parts after processing

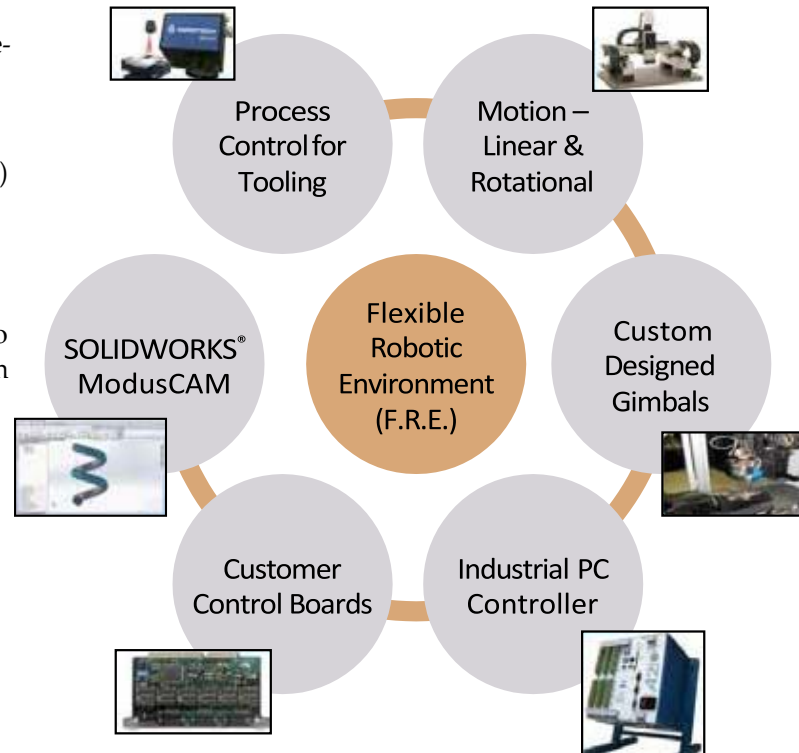


FRE Systems – Flexible Robotic Environment

The Flexible Robotic Environment (FRE™) is a robotic solution that combines Aerotech mechanical and motor/drive components with proprietary hardware, software, and controls. The end result is a cost-effective, highly innovative, and modular multi-degree-of-freedom (DOF) robotic package that can be configured for a multitude of manufacturing applications.

The FRE™ modular technology includes the following basic elements:

- Gantry and Linear Motion: Gantry systems utilizing precision linear motion motors of your choice for long movements
- Gimbal and Rotational Motion: Custom designed three-degree-of-freedom gimbal providing fluid motion for the rotational moves
- Signal Processing: A proprietary Direct Digital Synthesis (DDS) 6-axes drive board that is PC-based and is currently the only one available on the market
- Controller: Running on a real-time Windows® CE platform, the open architecture A2 Controller or A7 Controller is easy to integrate in a network using common networking systems such as LAN, USB, RS-232, RS-485, GSM, wireless LAN, and/or ZigBee
- Software: Every FRE™ system comes with a custom-made Man Machine Interface (MMI) supporting the modular FRE concept. Easily programmed, the MMI will be created with various complexities oriented towards satisfying your project requirements. This software's recursive direct and inverse kinematics algorithms will support even redundant manipulators creating a unique robotic system. In addition, the MoDus-CAM™ SOLIDWORKS® API was developed for path planning for any application.



About FRE Systems

Formed over nine years ago, Flexible Robotic Environment is a division of Bicommerce, LLC. FRE holds four patents in modular robotic technology and one provisional patent, two registered trademarks, and a copyright certification for all software. FRE is a woman-owned business, a registered government contractor, and a holder of a Preferred Shipper's number. FRE has strong European operations supporting in full: a) turnkey system integration, b) component manufacturing, c) design and d) engineering.



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