Robotic Assembly of Engine Components

Prof. Raymond J. Cipra

This research activity is sponsored by Ford Motor Company and has an overall goal to investigate robotic assembly and fault tolerant end effector design for automotive applications. Specifically the current project is to develop an automated device which can position and start screws while avoiding cross-threading and provide real time error recovery.

Automated Assembly of Micro-Scale Parts

Prof. Raymond J. Cipra

This project is sponsored by Sandia National Laboratory with the overall objective to automate the assembly process for micro-scale parts. The immediate goal of this project is to generate modeling and analysis capability to predict and determine the motion of micro-scale parts during self-guided sorting and assembly. Modeling the interacting forces and simulating the motion of these parts will aid in avoiding sticking and jamming problems during the actual assembly process.

Robotic Manufacturing of Carbon-Carbon Composites

Prof. Raymond J. Cipra

This project sponsored by the Indiana 21st Century Fund in conjunction with Honeywell ALS is investigating advanced manufacturing of carbon-carbon preforms used in aircraft brakes. Specifically a simulation model has been developed for the process of robotically spraying chopped fibers and computing their distribution. Current work is investigating robotic manipulation to provide near net shape and localized fiber orientation for increased strength.

Analysis, Synthesis and Design of Modular Digital Manipulators for Boundary Defined Workspaces

Prof. Raymond J. Cipra

This research activity has an overall goal to investigate modular digitally actuated robotic manipulators. The advantage of these manipulators is reduced weight and complexity, simplified control, and lower cost. The first objective of this research is to develop methodologies to synthesize a configuration of standard modules into a manipulator which can reach defined locations within a specified boundary, and to expand the method to optimize the configuration needed to best operate within the desired workspace. A second objective is to design and implement a digital actuator.

Self-reconfiguration of Chain-type Modular Robots

Prof. Raymond J. Cipra

Self-reconfigurable robots have the capability to change their configuration based on the environment and their operating task, and can do so without human intervention. For example, a robot might configure itself to move to a position at the base of a wall, then reconfigure to climb the wall, and finally reconfigure to retrieve an object on top of the wall. In addition to developing self-reconfiguration strategies, specific objectives include generating a kinematic reconfiguration strategy and finding optimal configurations to support external loads acting on the robot.