Rapid Prototyping

Manufacturing Technologies

The Rapid Prototyping Laboratory (RPL) supports internal design, manufacturing, and process development with three rapid prototyping (RP) technologies: Stereolithography (SL), Selective Laser Sintering (SLS), and 3D Printing (3DP).

Rapid prototyping uses advanced computer and laser technologies to produce complex three-dimensional prototypes in a fraction of the time required by more traditional technologies. The rapid prototyping process begins with a CAD solid model output to the appropriate RP file format. The file data is sliced into cross sections of 0.003 to 0.010 in. thickness. The cross sections are then fabricated in a layer additive process using one of the three available RP technologies.

The SL technology uses an ultraviolet laser to cure thin layers of epoxy photo-polymer. SL is used in the design iteration process to manufacture proof-of-concept models, models for design reviews, fit-check models, functional parts and patterns for castings or RTV molds. Accuracy is generally ±0.001 inch/inch

Rapid prototyping assembly using SL and SLS technologies

with a minimum of ±0.002 inch.

The SLS technology uses a carbon dioxide (CO_2) laser to fuse powdered polymer cross sections in a layer additive fashion. SLS is used to fabricate functional parts, pattern masters, conceptual models, fit check models, and mandrels made from DuraForm PA, a nylon based material. Typically, accuracy of the

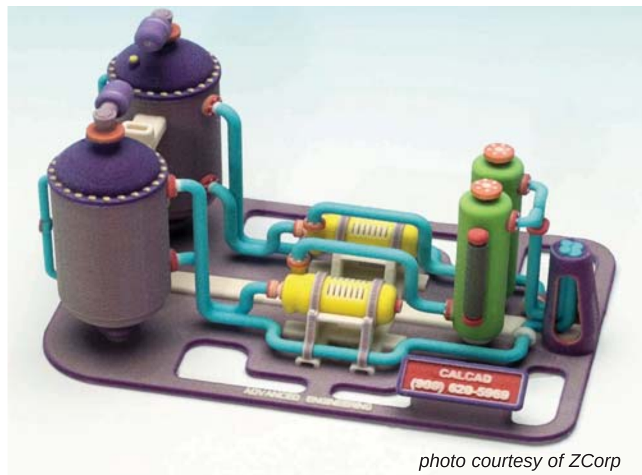


photo courtesy of ZCorp

Pump housing using 3DP technology

SLS process is ±0.002 inch/inch with a minimum of ±0.005 inch.

The 3DP technology uses ink-jet heads to print binder to fuse powdered polymer or ceramic cross sections in a layer additive fashion. This system has the capability of printing in full-color, communicating important information about parts, including engineering data, labeling, highlighting and appearance simulation. Parts are typically used as appearance prototypes for design and data review, and mock-ups for form and fit testing. The accuracy of the 3DP process is in the ±0.5% range.

Capabilities

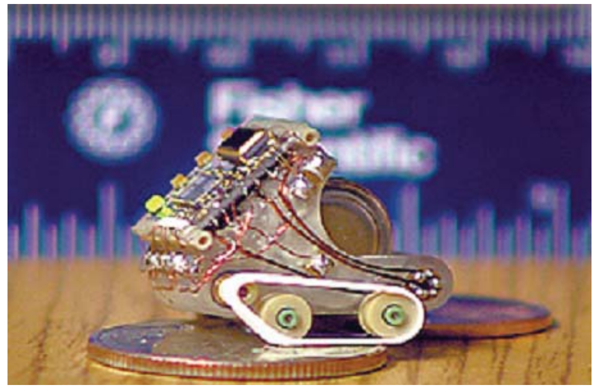
- Manufacturing of prototype components or assemblies from CAD solid models
- CAD solid modeling

- File manipulation and conversion
- Reverse Engineering
- Classified and proprietary SL and 3DP parts
- Color printing for data analysis, labeling and appearance simulation
- RTV molds and mold masters for urethane, epoxy, and RTV parts
- Tooling for wax or foam parts
- Investment casting patterns
- Mandrels for composite structures
- Special coatings for RP parts
- Precision model assembly

Patient-specific Pedicle Screw Placement Jigs

Resources

- Three Stereolithography machines
- Selective Laser Sintering machine
- 3D Printing machine with full RGB color capability
- CAD solid modeling using Pro Engineer or Solidworks
- Ability to utilize and manipulate a wide variety of data including: CAD solid models,



Mini-Autonomous Robot Vehicle (MARV)

radar, topographical, medical images, finite element analysis, MEMS design
- Three-dimensional laser digitizing system
- Metrology laboratory and machine shop

Accomplishments

- Fabrication of macro-scale MEMS components for design verification and visualization
- Ability to support various government agencies with 3D topographic maps from either Synthetic Aperture Radar or USGS data
- Design of complete process for fabrication of patient-specific pedicle screw placement jigs for foolproof spinal fusion surgeries
- Quick turnaround of precision fixtures for neutron generator production
- Uni-body fabrication to support development of mini-autonomous robot vehicle (MARV)
- Support penetrator design and development through fabrication of scaled mock-ups
- Fabrication of satellite boxes to support mock-up bench testing
- Provide technical support and prototype fabrication resources to small businesses

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