The YSU Excellence Training Center
Automated Foundry/Post Processing Lab

The Excellence Training Center at YSU
Project Organization

Defense Logistics Agency
  National Center for Defense Manufacturing and Machining (NCDMM)
  
  University of Northern Iowa
  Youngstown State University
  YSU Excellence Training Center
  Youngstown Business Incubator
  Humtown Products

Project Objective

To strengthen the domestic defense/DLA manufacturing supply chain
  • Demonstrating industry 4.0 technologies at the Excellence Training Center (ETC)
    o Building a foundry of the future and post processing lab
    o Performing additive metal research/using 3D printed sand molds in foundry
  • Assisting small to medium entities implement industry 4.0 technologies
    o Providing informational webinars
    o Providing workforce training at the ETC
    o Providing business case analysis
Industry 4.0 Technologies

- Robotics, Automation (Programmable Logic Controllers (PLCs))
- IT infrastructure (digital twin/digital thread)
- Embedded Sensor Technologies
- Additive Manufacturing
  - 3D printing hard and soft tooling
  - 3D printing sand molds
  - 3D printing metal research

Automated Foundry
Post Processing

Goal:
Develop a methodology to increase the flexibility of robotic systems to remove casting features with 3D vision that can be implemented by SMEs in the DLA supply chain.
- Minimize hard tooling and fixtures
- Increase robot cell flexibility
- Reduce programming requirements

Equipment:
- Standard robot – Fanuc M900iB
- Vision System – Fanuc iRVision
- Tooling/Fixtures – COTS components
- Sensors – COTS sensors (ex: Dialog IoT)

Post Processing

Reducing programming complexity
Principles and methods exist to greatly reduce the programming logic required for a flexible toolpath.
- Standard identifiable features (reference library)
- Availability of 3D models for most castings

More feasible to implement by SMEs
- Lowers the programming requirements for shop personnel
- Lowers cost of tooling and decreases time to program

Increasing process control
Sensoring the process (in-situ) detects problems as they happen.
Availability of inexpensive wireless with simplified programming lowers barriers to entry of SMEs.
Automated Scanning Cell

Part verification can be a long and tedious process in the DoD supply chain. Parts often need to go through multiple dimensional checks to ensure they meet requirements and typically requires a worker to have hands on a part for hours at a time between setup and dimensional reporting.

Key points

- Less man hours required for validation work, after the initial setup process, operating the cell is easy.
  - After initial setup by an engineer or technician, any person can run the program by setting a part and pushing a button.

- Faster than traditional methods of scanning/validation.
  - Scanning by hand takes time and is an involved process
  - Touch probes such as Faro arms or CMM's have a long setup time
    - Measurements taken are only 'point' measurements

- It has a more accurate, less dense point cloud
  - Metrolog programs the optimal scan path based on reference model features
    - It uses scanner standoff and part geometry
Automated Scanning Cell

How it works

Metrolog X4 i-Robot is an agnostic program that ties in the selected robot and scanner needed for the application
• This means you can choose from almost any manufacturer of robot or measurement device.

Metrolog is the programming and reporting software
• Metrolog controls the robot and the scanner telling them how to move and operate but uses the scanners proprietary software to acquire the point cloud

By using VXElements to acquire the point cloud allows for the best possible scan data to be captured with the scanner.

Scanning Process

Robot setup
Reference CAD Data Setup
All robot movements auto programmed by Metrolog
Process for aligning scan data to reference data
Dimensions and tolerancing being measured for reporting
Final Dimensional Report
Scanning Process

Running the Program

Metrolog works directly with the Handyscan’s VXElements to capture the scan data

Scan data is directly transferred into Metrolog

Metrolog auto aligns the Scan Data and Cad Data

Total time from scanning to reporting is 1 minute unmanned per part
Scanning Process

Thank you!
Andrew Prokop