Methodology for Repair Using Hybrid Manufacturing

Aniruddh Kommareddy, Aidan Brooks, and Dr. Douglas Bristow

Department of Mechanical and Aerospace Engineering
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Introduction
- Hybrid manufacturing combines additive (AM) and subtractive (SM) manufacturing techniques
- The AM process creates a near-net shape of the part, which is then finished using SM techniques, such as milling or turning, to achieve the final dimensions and surface quality.

Main Goals of Our Project
- This research aims to create a method to restore damaged parts or tools to their original state using a 3D scanner.
- The objective is to improve efficiency in part fabrication and enable repair of valuable parts with complicated geometries.

Approach
This research mainly focuses on creating a methodology and documentation for the full process of:
- Data Collection
- Machining
- Efficient Data Usage
- Data Analysis

Data Collection
- Created methodology for 3-D scanning, cleaning meshes, aligning coordinates, and reconstructing missing dimensions

Data Analysis
- After machining, the finished product will need to be compared to a reference CAD model or scan. Documentation was created to show various methods.

Efficient Data Usage
- Created methods to reduce data post processing. This includes:
  - Selective Data Reduction
  - Changing to efficient file types
  - Mesh Boolean Data Selection

Conclusions
- In conclusion, once the DMG Mori machine is mechanically functioning smoothly, the tools and documentation developed within this research can aid in repairing Toyota engine die parts with a hybrid machining workflow.
- Ultimately, the aim is to create a comprehensive program for Missouri S&T to instruct other universities on operating a hybrid additive and subtractive machine.