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Sensors & MicroActuators Learning Lab

POSTPROCESS
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POST-PROCESS EFFECTS ON DYNAMIC SYSTEM MODELS CREATED FROM ADDITIVE MANUFACTURING

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1. Introduction

- **Dynamic System Creation and Processing**
  - ✓ Developed various dynamic models via additive manufacturing to quantify effects of post processing on these models.
  - ✓ Post processing conducted by WNY's PostProcess, using proprietary methods to smoothen and finish individual parts of the model.
  - ✓ Goal is to reduce stress and friction of moving dynamic models and reduce reliance on older processing methods.
- **Original and Post-Processed Model Experimentation**
  - ✓ Average surface roughness via profilometer
  - ✓ Dynamic model input torque, rolling resistance, and thermal resistance

2. Methods

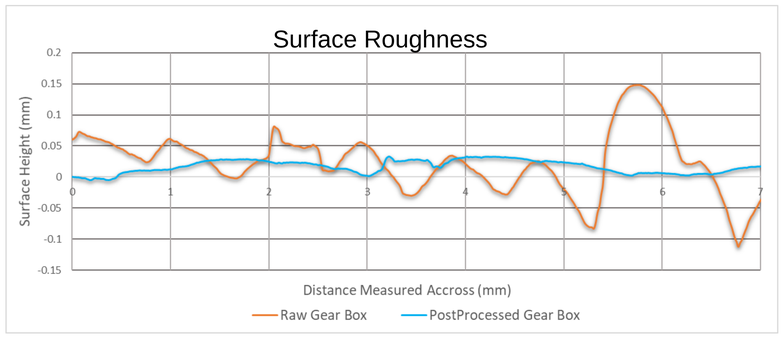
- **Post Processing**
  - ✓ PostProcessed using the NITOR (Fig 1.)
  - ✓ Using tumblers with the proper sanding media for the material, gradual edge sanding, support removal and surface finishing across the entire part is conducted.
  - ✓ Controllable operating parameters
    - ✓ Heat
    - ✓ Frequency
    - ✓ Amplitude
    - ✓ Lubricity

Fig. 1. The surface finishing machine NITOR developed by PostProcess

- **Model Development**
  - ✓ All parts printed with PLA on Folger Tech FT-5 3D Printer
  - ✓ Models post processed then assembled by UB's SMALL

3. Experiment and Results

- **Surface Roughness**
  - ✓ The same 7.0 mm area was selected was a surface roughness scan using a Tencor Profilometer.



- ✓ 38% reduction in surface roughness and reduced variance of surface level
- ✓ 0.2815 µm (Ra) to 0.1092 µm (Ra)

Pre-Processed

Post-Processed

Fig. 2. Close up images of Pre / Post Processed 3D Printed parts.

- **Gearbox Thermal Resistance**
  - ✓ Pre and post processed gearboxes spun at 300 rpm for 120 seconds.
  - ✓ Images at same heat-scale.

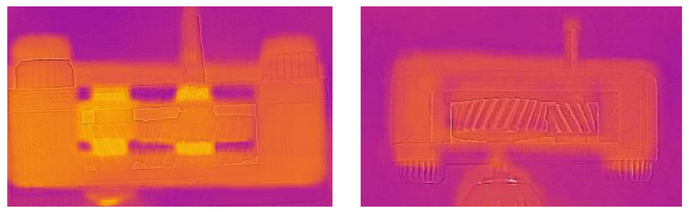
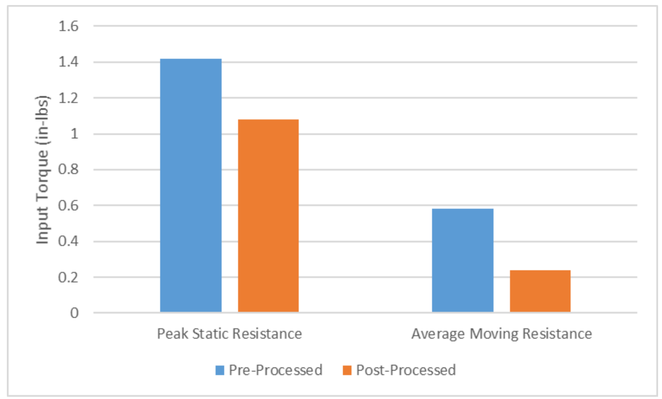


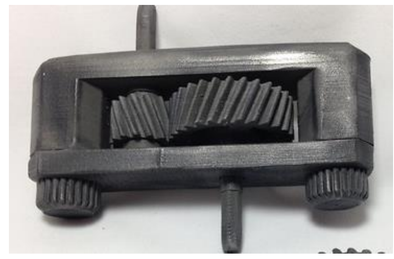
Fig. 3. Thermal images using a FLIR Pro thermal imaging camera. (Left) Pre-process gear box showing heat generation due increase contact friction. (Right) Post Processed part showing low heat levels.

- ✓ Excess heat generated at gear teeth and shafts on pre processed gearbox
- ✓ Post processing reduced friction, leading to only residual heat across entire gearbox after spinning.

- **Gearbox Input Torque and Rolling Resistance**
  - ✓ Peak static torque and average moving torque measured at larger gear.
  - ✓ Data collected before and after thermal test for consistency.



- ✓ 23.9% drop in peak static resistance
- ✓ 58.6% drop in average moving resistance



4. Conclusion & Future Work

- ✓ Post processing dynamic models resulted in a reduction in average surface roughness, rolling resistance, and heat generated upon rotation.
- ✓ Reduction in surface roughness results in an improved aesthetic appearance and finish of processed parts and models.

Fig. 4. Final Post Process Engine