Reproducibility Report

for the paper, Jin, Iquebal, Bukkapatnam, Gaynor, and Ding, 2020, "A Gaussian process model-guided surface polishing process in additive manufacturing." *ASME Transactions, Journal of Manufacturing Science and Engineering*, Vol. 142(1), pp. 011003.1–011003.12.

The above-referenced paper is an open-access paper.

1 Computer and software environment

Software used: MATLAB® (R2020b)
Hardware and Operating System: Any operating system capable of installing MATLAB software (Windows/ MacOS/Ubuntu etc.).

2 The data files

Figure1_data folder contains three *.csv* files that are the output files converted from the raw data of surface roughness measured by a ZeGage™ 3D optical profiler, named "Zygo" after its producer. The raw data contains the pixel heights of 1024×1024 pixels that measures a surface area of 800×800 μm. The converted *.csv* files contain the Bearing Area Curve that are in fact height quantile curve converted from the measured surface data.

Experiment#1_data folder contains 26 sub-folders that are named with the stage number, and a *.cvs* file, "FixPointsCoordinates.csv", recording the coordinates of (x_1, x_2) of the sample locations. For this first set of experimental data, we polished the surface to Stage 25 and measured the surface roughness of 32 sample locations per stage. One may find 32 *.csv* files, each corresponding to a sample location, in each sub-folder. The sub-folder, "Stage0", has the roughness measurement for the unpolished surface that is we call the raw surface. The *.csv* files contain the surface roughness height data converted from the raw surface roughness data.

Experiment#2_data folder contains 23 sub-folders that are named with the stage number, and a *.cvs* file, "FixPointsCoordinates.csv" that records the coordinates of (x_1, x_2) of the sample locations. For this second set of experimental data, we polished the surface to Stage 22 and measured the surface roughness of 32 sample locations per stage. One may find 32 *.csv* files, each corresponding to a sample location, in each sub-folder. The sub-folder, "Stage0", has the roughness measurement for the unpolished surface that is we

call the raw surface.

Simulation_data folder contains two sub-folders: "GuidedBySa" and "GuidedByThetaX".

- **GuidedBySa** folder contains 11 sub-folders that are named with the stage number, and a *.cvs* file, "FixPointsCoordinates.csv" that records the coordinates of (x_1, x_2) of the sample locations. For this set of simulation data, we simulated the surface roughness removal supposing the polishing process is guided by Sa threshold.
- **GuidedByThetaX** folder contains 9 sub-folders that are named with the stage number, and a *.cvs* file, "FixPointsCoordinates.csv" that records the coordinates of (x_1, x_2) of the sample locations. For this set of simulation data, we simulated the surface roughness removal starting with the same roughness condition as Stage 1 of the simulation guided by Sa. As guided by θ_x, the pad should be changed at the end of Stage 2. Thus, this set of simulation data reflects the condition of the surface polishing guided by θ_x.

Table 1 summaries the data files and their names in each data folder.

Table 1: Data files organization

Data folder name	Number of files	File names
Figure1_data	3 csv files	320.csv 328.csv 409.csv
Experiment#1_data	26 folders and 1 csv file	Stage[0..25] FixPointsCoordinates.csv
Experiment#2_data	23 folders and 1 csv file	Stage[0..22] FixPointsCoordinates.csv
Simulation_data/GuidedBySa	11 folders and 1 csv file	Stage[1..11] FixPointsCoordinates.csv
Simulation_data/GuidedByThetaX	9 folders and 1 csv file	Stage[3..11] FixPointsCoordinates.csv

3 Reproducing the results in the paper

Table 2 below documents the workflow of reproducing the results in the paper.

Table 2: Reproducibility workflow

To reproduce	Input data file	Code file	Output
Figure 1	Figure1_data	Figure1_code	Figure1_a.png, Figure1_b.png, Figure1_c.png
Figure 5	Experiment#2_data	Figure5_code	Figure5_a.png, Figure5_b.png, Figure5_c.png
Figure 6	Experiment#2_data	Figure6_code	Figure6_a.fig, Figure6_b.fig, Figure6_c.fig
Figure 7	Experiment#2_data	Figure7_code	Figure7_a.png, Figure7_b.png, Figure7_c.png Figure7_d.png, Figure7_e.png, Figure7_f.png
Table 2	Experiment#1_data	Table2_code	Table2.xlsx
Table 4	Experiment#2_data	Table4_code	Table4.xlsx
Table 5	Simulation_data/GuidedBySa	Table5_code	Table5.xlsx
Table 6	Simulation_data/GuidedByThetaX	Table6_code	Table6.xlsx